EDISON ELECTRIC INSTITUTE BULLETIN

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EDISON ELECTRIC INSTITUTE

STATISTICAL DATA OF THE ELECTRIC LIGHT AND POWER INDUSTRY

Compiled Monthly by the Edison Electric Institute—Covers 100% of the Industry

DURING THE MONTH OF NOVEMBER

	1937	1936**	%
Kilowatthours Generated* (net)			
By Fuel	5,899,187,000	6,151,054,000	− 4.1
By Water Power	3,415,386,000	3,024,741,000	+12.9
Total Kilowatthours Generated	9,314,573,000	9,175,795,000	+ 1.5
Additions to Supply			
Energy Purchased from Other Sources	298,181,000	216,559,000	+37.7
Net International Imports	95,450,000	81,737,000	+16.8
Total	393,631,000	298,296,000	+32.0
Deductions from Supply			
Energy Used in Electric Railway Departments	50,519,000	54,247,000	− 6.9
Energy Used in Electric and Other Departments	121,208,000	126,102,000	− 3.9
Total	171,727,000	180,349,000	− 4.8
Total Energy for Distribution	**9,536,477,000**	**9,293,742,000**	**+ 2.6**
Energy Lost in Transmission, Distribution, Etc.	**1,368,858,000**	**1,282,899,000**	**+ 6.7**
Kilowatthours Sold to Ultimate Customers	**8,167,619,000**	**8,010,843,000**	**+ 2.0**
Sales to Ultimate Customer (kwhrs)			
Domestic Service	1,613,651,000	1,440,086,000	+12.1
Commercial—Small Light and Power (Retail)	1,599,855,000	1,409,939,000	+13.5
Commercial—Large Light and Power (Wholesale)	4,201,369,000	4,387,997,000	− 4.3
Municipal Street Lighting	199,067,000	206,132,000	− 3.4
Railroads—Street and Interurban	370,348,000	379,141,000	− 2.3
Railroads—Electrified Steam	103,965,000	109,130,000	− 4.7
Municipal and Miscellaneous	79,364,000	78,418,000	+ 1.2
Total Sales to Ultimate Customers	8,167,619,000	8,010,843,000	+ 2.0
Total Revenue from Ultimate Customers	$187,296,300	$180,906,200	+ 3.5

DURING TWELVE MONTHS ENDING NOVEMBER 30th

Kilowatthours Generated* (net)			
By Fuel	74,332,656,000	68,279,414,000	+ 8.9
By Water Power	40,798,280,000	36,896,960,000	+10.6
Total Kilowatthours Generated	115,130,936,000	105,176,374,000	+ 9.5
Purchased Energy (net)	4,696,760,000	3,025,954,000	+55.2
Energy Used in Electric Railway and Other Departments	2,018,555,000	2,240,357,000	− 9.9
Total Energy for Distribution	**117,809,141,000**	**105,961,971,000**	**+11.2**
Energy Lost in Transmission, Distribution, Etc.	**17,688,767,000**	**17,266,815,000**	**+ 2.4**
Kilowatthours Hours Sold to Ultimate Customers	**100,120,374,000**	**88,695,156,000**	**+12.9**
Total Revenue from Ultimate Customers	**$2,193,460,500**	**$2,033,265,100**	**+ 7.9**
Important Factors			
Percent of Energy Generated by Water Power	35.4%	35.1%	
Domestic Service (Residential Use)			
Average Annual Consumption per Customer (kwhr)	799	730	+ 9.5
Average Revenue per Kwhr (cents)	4.40¢	4.70¢	− 6.4
Average Monthly Bill per Domestic Customer	$2.93	$2.86	+ 2.4

BASIC INFORMATION AS OF NOVEMBER 30th

Generating Capacity (kw)—Steam	24,221,700	24,105,100	
—Waterpower	9,611,100	9,492,600	
—Internal Combustion	678,500	614,100	
Total Generating Capacity in Kilowatts	34,511,300	34,211,800	
Number of Customers			
Farms in Eastern Area (Included with Domestic)	(885,082)	(758,266)	
Farms in Western Area (Included with Commercial—Large)	(304,988)	(277,311)	
Domestic Service	22,465,296	21,629,124	
Commercial—Small Light and Power	3,878,003	3,800,078	
Commercial—Large Light and Power	567,189	558,735	
Other Ultimate Customers	73,398	67,011	
Total Ultimate Customers	26,983,886	26,054,948	

* By courtesy of the Federal Power Commission, with deductions for certain plants not considered electric light and power enterprises.
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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 6 FEBRUARY, 1938 No. 2

TVA and the Electric Utilities

By Dr. William L. Grossman

Instructor in Public Utilities, New York University School of Commerce

A radio address on the program of the Forum Division, W.P.A. Adult Education, Station WNYC, February 6, 1938, 11:00 a. m.

LET us assume as a premise that there is nothing necessarily wrong with government ownership. There are those who maintain that all government ownership is bad; they will naturally oppose the electric power activities of TVA, and will therefore accept my case as a matter of course. I am not interested in them. I want to talk to two other groups of people—first, to the liberals who have no predilection for or against public ownership; and second, to the socialists.

The liberals consider each case on its own merits. They will ask, among other things, whether our government is well advised under the existing circumstances in choosing to go into the electric light and power business rather than the food or clothing business. No good reason for the choice has ever been offered and none, in my opinion, can be given. The average manual worker in this country spends less than two per cent of his money for electricity. Even if his use of electricity were doubled, the item of expense would be very small compared with his expenditure for food or clothing. The daily cost of electricity per family is lower than the cost of an ice cream soda—and I am not referring to the expensive fifteen-cent variety. A recent survey shows that the worker spends less for electricity than he does for fuel, or for transportation, or for medical care, although these items themselves represent much smaller expenditures than either food or clothing. It cannot be said, then, that the administration in Washington has gone into the electric business in order to save the consumer money. If that were really its concern, it would have chosen to subsidize the cost of the large items on the family budget. We should have, instead of federal electric power projects, great federal clothing projects and government-owned enterprises producing and distributing food.

A possible and legitimate reason for government entry into a particular industry would be found if the industry was backward and unprogressive. But the electric light and power industry has been anything but that. It has brought down the price of electricity to the domestic consumer 50 per cent in the past twenty-five years. In other words, rates have been cut, in that time, from almost 9c to less than 4½c per kilowatthour. Even other classes of utility companies—such as railroads, gas companies, etc.—have effected no such reduction. The cost of food and clothing hasn't gone down; it has in fact increased and at the very same time that so much solicitude has been expressed for the consumer of electricity. It will of course be recognized as an old political trick to make a great fuss and furor about what doesn't matter in order to divert attention from the really important problems. No one criticizes the power and light companies as to the quality of electric service. Nor can any legitimate complaint be brought against the quantity of electric service—in fact, a much larger percentage of the population receives electric service in the United States than in any other country of comparable size on the face of the globe—and the industry was expanding at a phenomenal rate before it became a political football. Why in the world should the government decide to go into business in one of the few industries which are expanding, which are cutting rates continually, and in which service is nearly perfect? The greatest thing the government could do for the electric consumer, and not only for the consumer, but for the employee and citizen, would be to lay off and to face some of the genuine difficulties of our times.

The inappropriateness of government ownership in this field is especially apparent when we stop to consider that the private electric utility companies are now being regulated by the state and federal governments in every important particular. The vast majority of states have commissions that fix electric rates, fix standards of electric service, and in fact control almost every aspect of their business conduct. The Federal Power Commission regulates the electric industry in so far as it engages in interstate commerce. The Securities and Exchange Commission regulates electric utility holding companies. An electric company can't blow its own nose today without three or four commissioners jumping up to tell what handkerchief to use.

Proponents of federal activity in the field of electric light and power persuaded Congress to enact the Public Utility Act of 1935, giving the Federal Power Commission and the Securities and Exchange Commission the powers just referred to. Apparently commission regulation is regarded as a real safeguard of the rights of the public. The advocates of TVA maintain that state commissions, which regulate local rates, etc., have not done a good job. But certainly the steady reduction in rates, the widespread improvement in service, and the continual expansion of the industry, indicate either that the companies have done a good job voluntarily, or that the commissions have done a good job in regulating them—or both. Moreover, if public officials—and commissioners are

public officials—are really so ineffective, why build governmental electric projects and put public officials in charge of them? Men don't change overnight from sinners to saints just because their official title is altered.

I have tried to indicate the reasons why the electric light and power industry is a particularly inappropriate field for government ownership. But these reasons will not satisfy the thoroughgoing socialist, because he favors the principle of government ownership in all fields. Now, as a matter of fact, I think the socialist ought to be particularly critical of TVA. Socialists know what a difficult job it is to make converts. It would help them a great deal to be able to point to a few successful business enterprises owned by the federal government. They can point to the post-office, but the rejoinder is made that the post-office doesn't pay for itself, that it loses money. Within the field of non-federal government ownership, they can point to municipal electric plants; but the typical municipal plant regularly pays lower taxes than power and light companies do, it charges rates more than twice as high as the TVA rates, its service often is not what it should be, judged by private standards, and it keeps accounts so irregularly that you can't tell whether it pays for itself or whether the taxpayers are subsidizing it. Except for a little spurt during the depression and when PWA funds became available, municipal plants have failed to keep pace with the growth of the industry. Only about five per cent of our electric light and power is supplied by them. More municipalities have given up public ownership of electric establishments than at present have publicly owned establishments.

Now, TVA has assured us that it could sell electricity more cheaply than the private companies and yet be able to pay for itself. If it kept this promise, and published facts to show that it kept it, socialists would have something to talk about. They would be put, at last, in possession of the benefits of a concrete incontrovertible example of the benefits of federal ownership of a business enterprise. If, as seems more likely, it becomes public knowledge that TVA and those who distribute its power simply sell electricity at low rates to a few people at the expense of a great many other people, the socialist cause will receive a black eye from which it will not be easy to recover.

You see, TVA in actual practice has made little effort to demonstrate that it is really self-supporting. It's a pretty safe bet that TVA does not and will not pay for itself. One of the chief costs of supplying TVA electricity is the interest on the money that the government had to borrow to build the electric facilities. But advocates of TVA say that it pays no interest, so why charge rates high enough to cover any interest? Of course, TVA as a separate legal entity pays no interest, but the government pays interest for it, and that means that you and I pay interest for it. You and I foot the bill and that is true whether we pay federal income taxes or not. Every time we pay an electric bill, for example, we are paying taxes to the federal government, because the federal government taxes the electric companies and thus increases the rates that the companies must charge if they are to keep in business; and those taxes are being used in part to pay interest on loans incurred by the government for TVA. In short, people in Alabama and Mississippi and Tennessee are getting cheap electricity because people in New York and New Jersey and Pennsylvania and other states are paying for it. It seems like a sort of poetic injustice to oblige us, as consumers of electricity to pay in our electric bills, part of the cost of electricity distributed to consumers in TVA territory. This subsidy by government financing is only one of several which make it possible for TVA to charge low rates. Thus some of the municipalities which distribute TVA electric energy, have constructed their plants with the help of PWA grants from the federal government. Here, again, the taxpayer foots the bill. And here again, the taxpayer is not only the man or the corporation that makes the formal tax payment to the government, but all of us who have to pay higher prices for things because of the taxes hidden in those prices.

Looking at the TVA electric project as a whole, I cannot escape the conclusion that it is, as one writer puts it, simply an "adventure in philanthropy," with you and me, whether we like it or not, as the philanthropists.

I use the words "you and me" advisedly. I happen to be a New Yorker, and probably you who are listening live either in New York or in New Jersey. In the fiscal year 1937 we New Yorkers and Jerseyites paid to the federal government one-half billion dollars more than we received from the federal government for relief and all other purposes. A part of this excess payment was spent on electric power for TVA consumers in Mississippi, Tennessee and Alabama. At the same time, the people of those states were receiving more from the government than they were paying to the government. In other words, while we were providing a huge fund to subsidize the sale of TVA power, the people who were reaping the benefit did not even pay their proportional share of the subsidy. And so it is again, with a certain preciseness that I may say to listeners in this part of the country that you and I are the philanthropists in the case.

It should be borne in mind, of course, that many of TVA's consumers, getting the benefit of low TVA rates, are not individuals or families but big industrial corporations. (TVA has made a point of attracting such corporations to its territory by means of subsidized electric rates.) In the dramatizations and other propaganda put forth by supporters of TVA, emphasis is invariably placed upon the farmer consumer. I wonder how effective the propaganda would be if instead of the farmer some of the large consumers, the great industrial concerns, were exhibited as the beneficiaries of our philanthropy, and if it was shown that the ordinary citizen in New York is being obliged to pay for cheap TVA electricity served to these corporations.

Since TVA rates are subsidized rates, made artificially low by contributions from all of us, there is no point in comparing them with rates charged by power and light companies. It is obvious that TVA rates will be lower. If we don't mind raising taxes a little higher, we can make it possible for TVA to give electric power away free or even to pay people for using it. That wouldn't mean that the power didn't cost anything to the nation. Cost and price are two very different things.

To conclude: A great deal of what is said about TVA can be verified or disproved only by a thorough investigation of TVA. The Federal Trade Commission, under congressional authority, made an eight-year investigation of the private electric utility companies. *Isn't a bona fide inquiry into the inner workings of the great governmental electric utility company now in order? I rather think the results of such an investigation would convince both liberals and socialists that, in supporting TVA, they are simply promoting an ultra-modern type of political free lunch—in short, that the TVA electric power program is nothing but a streamlined pork-barrel.*

Home Power Plants

By C. W. Kellogg
President, Edison Electric Institute

THE chapter on Power in the report of the National Resources Committee, published in July, 1937, gives the amounts of power in various categories for the United States as of 1935. These figures, condensed for simplicity of presentation, showed the following totals in millions of horsepower:

Motor Vehicles	965
Railroads, Steamboats and other Transportation	124
Agricultural Prime Movers	73
Electric Central Stations	45
Industrial and Miscellaneous Power	24
	1,231

These simple figures lead to some interesting reflections. They indicate, for example, that 88.5% of the nation's power is used to propel instrumentalities of transportation and is therefore mobile, and that at least 78½% of the total is on rubber tires and moves about the highways. The figures show the so-called huge electric power industry to be a mere pigmy, representing but 3⅜% of the total power of the country. A simple calculation from the figures reveals that the cars which rolled off the assembly lines of the automobile factories of the United States in one year (1936) had four times as much combined power as all the electric power houses of the nation, both steam and hydro, which had been 30 or 40 years in the building. It is interesting to note also that the power on rubber tires is about eight times as great as that represented by the combined total of all railroads, steamships, electric railways and aeroplanes.

The comparisons just cited are of course obvious from the source figures quoted from the report of the National Resources Committee. They give rise to other considerations that are perhaps not so obvious and the discussion of which is the purpose of this paper.

The drastic effect of the 26,000,000 motor vehicles now traversing our highways on the mass transportation business, represented by the steam and electric railroads of the nation, is too well known to require any comment. It inevitably raises the question, however, as to whether the possibility of millions of individual electric plants in millions of homes represents a threat to the electric light and power industry similar to that which individual transportation has made effective with respect to the mass transportation industries. My analysis of the situation convinces me that no such threat exists, as I shall now try to elaborate.

Mass transportation and central station electric service have this in common, that each represents an effort to produce in a cooperative way for large numbers of people a service which each one could not produce so economically for himself. Beyond this common point the basic methods diverge completely. Mass transportation requires the establishment of fixed common routes of travel or movement and movement at fixed times, often relatively infrequent, to which conditions of place and time the individual who desires to use the service must accommodate himself, often after considerable inconvenience to himself. There are also capacity limitations at the very time most people desire to use the service. In a word, with transportation service the individual must conform to the average requirements and this is unavoidable in the nature of the business.

With respect to electric service, however, the exact reverse is the case, the service being furnished to each individual the instant he wants it, at the precise place where he wants it and in the amounts he needs, without personal inconvenience and without fear of crowding or danger of delay.

It can probably be demonstrated in most cases that mass transportation is the cheapest way to move either passengers or freight, so that the tremendous rise in the use of the individual transportation unit, with its adverse effect on the mass transportation business, was a victory of flexibility and convenience over economy in the satisfaction of individual desires. Perhaps the most striking proof of the correctness of this diagnosis is the well known fact that mass transportation business of any kind is affected least by individual transportation where the inconvenience of individual transport is the greatest, and vice versa.

There is nothing novel about an individual home electric plant. They have been made and sold by the thousands and have automatic control features which make their operation in the home considerably less troublesome than the operation and maintenance of an automobile. Why, then, if any menace to the central station existed from this source, has it not long ago made itself manifest. A simple analysis based on the fundamentals of our business shows, I believe conclusively, why central station service is vastly preferred by the public over what it could get from its own home plant.

In the first place, remembering that, as the transportation experience has shown, people "want what they want when they want it," the reliability of central station electric service is now so nearly 100% as to be practically perfect, not only as to time and place but as to amount and quality. It represents not only adequate capacity but adequate reserves to back it up in case of the breakdown of one unit. This reliability is much lower with the home electric plant, which, if it is down, is completely out.

In the second place, individual electric needs are constantly changing upward and the stone wall which the individual would face when his needs grew above the capacity of his home electric plant does not exist for the user of central station supply. The individual would thus face the dilemma of either having to make apparently excessive initial investment or of being unable, without substantial investment, to make some very desirable use of electricity when the need for it arose.

These two points mean that convenience and flexibility (which were the basic reasons for the rise in individual transportation) are the very strongest reasons deterring the individual from attempting to furnish his own electric supply service.

In addition to reliability and flexibility, central station service, once connected, represents practically no thought or inconvenience of any kind, while even the most perfect home generating set must be supplied with fuel, lubrica-

tion and battery care just like an automobile.

While I believe that reliability, flexibility and convenience are the things most desired by the public in electric or any other service, I do not feel that this subject should be dropped without a consideration of its strictly economic aspects. Here we find the extraordinary effect of diversity working powerfully on the side of the central station. (The exact opposite of diversity is, by the way, one of the greatest bugbears of mass transportation).

Analysis of figures for the largest company in the group I represent (which is reasonably typical of the electric industry) shows an average investment in plant of about $225 per residence customer, whose diversified pull on the power station is about ½ kilowatt. These figures allow for the higher unit distribution investment for residence business, for distribution losses back to the power station and for reserve capacity. Due to residence diversity being about one in three, the corresponding individual peak would average 1½ kilowatts and allowance for some spare capacity for growth would require a 2-kilowatt individual plant to represent even inadequately what the central station furnishes as a capacity. Such a plant, consisting of a self-starting gasoline engine, generator and accessories, would cost installed about $700, or over three times the average central station investment which it purported, though inadequately, to replace. It is doubtful if the individual could raise money any cheaper than the central station or would be satisfied with any less rate of return. If we take 12% for fixed charges (which is about what the electric utilities average for return on investment, depreciation and taxes) they amount to $27.00 a year per residence customer for the central station and $84.00 a year for the home plant. This comparison is not fair to the central station since a gasoline engine would depreciate much faster than a steam turbine, but we will let it stand.

The company to which I refer averages to sell its residence customers 1055 kwhr. per annum, for which it receives an average of $40.81 per annum. Deducting from this the $27.00 we allowed for fixed charges, leaves $13.81, or 1.31 cents per kilowatt hour for all other expenses connected with furnishing residence service. How does this compare with what could be done with an individual home plant of 2 kilowatts capacity? We can reasonably assume an average of one-half load on the home plant, and while the fuel economy curve of a gasoline engine is not a straight line (thus heavily penalizing light loads) still we will take the maker's representations as to half-load fuel economy, which is 0.374 gallons of gasoline per kwhr. With a gasoline price per gallon of 10c., resulting from tank wagon delivery and the elimination of highway taxes, we get a cost for fuel alone of 3.74c. per kwhr. To this must be added lubrication and maintenance, estimated at 1.4c., making a total of 5.14c. per kwhr.

We thus see that with all the relatively inferior reliability, flexibility and convenience of the home electric unit compared to central station service, the small individual plant is further handicapped by costing over three times as much to install and about four times as much for operation, exclusive of fixed charges, as typical central station service to a typical customer.

If you agree, as I think you must, that I have demonstrated conclusively why the central station business has not *up to now* suffered from individual self-service the way the transportation business has, then the argument is even stronger for the continuation of this immunity in the future. For with future growth with the individual home plant, unit costs will continue about as now; while on the other hand the *additional* requirements of a customer of central station service will (due to the effect of inducement rates) be at rates far below the average rate paid prior to using such additional requirements.

The fact that the number of passenger automobiles in the country is about the same as the number of residential electric customers makes a comparison of the relative expenditures on these two items a matter of interest. Reports of the Department of Commerce, supplemented by estimates of some items not reported, show that on or in connection with the 21,000,000 passenger automobiles, including annual replacements, no less than $6,000,000,000 is spent per year country-wide. This is 8½ times as large as the $700,000,000 expended by the 21,000,000 household users of electricity for central station service. These figures emphasize what the American citizen will pay for comfort and convenience and I believe also clinch the argument that if the average citizen were not completely satisfied that his central station service gave him the maximum obtainable in convenience, flexibility and dependability, mere cost would not stop him from resorting to other means to that end. Of course, when the considerations of cost on the one hand and flexibility and convenience on the other both favor central service so strongly, as they do in most cases, no tendency to go to home plants exists.

I should regret it if my paper appears to be a general condemnation of small home electric plants, for that is not true. There are millions of isolated farms in our country, where the small electric generating set is of tremendous value in furnishing the blessings of electricity not otherwise obtainable. Summer camps, isolated construction jobs and numerous other conditions exist where the problem of electric service can be solved economically in no other way. I am convinced that the individual generating unit is the most economical solution of farm electrification where farm density is as low as it is in the case of two-thirds of the farms of the country. My paper has considered only the conditions surrounding our 21,000,000 home customers and for them I believe the facts prove overwhelmingly that central station service is the best for the home customer from whatever angle considered, and they indicate clearly why the homeowner feels the same way about the matter.

The confirmed and determined pessimist might say that, admitting the soundness of the conclusions presented, there was always the possibility of someone discovering some new way of unlocking the energy in the atoms. I am not so rash as to say that this energy source will never be tapped by mankind for commercial purposes. We do at least know that the release of this energy can be effected only at temperatures which would appear to be very expensive to obtain and maintain. It is fair, therefore, to assume that the recovery for commercial use of inter-atomic energy could not be expected to effect any decrease in power plant charges. With such charges therefore eliminated from the equation, we become concerned only with the fuel differential, which has now gotten down in the most modern design to 1.4 mills per kwhr. (10,000 Btu per lb., for 14,000 Btu coal, at $4.00 per ton). Dependability and flexibility will still be on the side of central station service, as indeed they would be if the cost of production became zero.

The Problem Employee

A Mental Health Program for the Electric Utility Industry

By Morris S. Viteles, Ph.D.

Associate Professor of Psychology, University of Pennsylvania, and Director of Personnel Research and Training, Philadelphia Electric Company

IN the latter part of 1930 a manufacturing plant, faced by a decline in business, found it necessary to lay off a number of employees in a department manned by highly skilled workers. The accident record of this department had been outstandingly good. Almost simultaneously with the reduction of force came an increase in the accident rate. Moreover, accidents became more frequent and more serious as lay-offs continued. This happened in spite of the fact that lay-off was largely on the basis of seniority and skill, so that, as lay-offs progressed, the group remaining at work contained an ever-increasing proportion of experienced, skilled workers.

The Relation Between State of Mind and Accidents

A further analysis of accidents showed another interesting phenomenon. The accident rate was consistently higher in the group which was next in line for lay-off. It is not difficult to find an explanation for this. Worry, induced by impending lay-off, affected the performance of those men who remained in employment. Attention was distracted from the task at hand as the worker turned to pessimistic day-dreaming about his future. Alertness gave way to inattentiveness; precision and certainty to inaccuracy and uncertainty in response. In other words, an emotionally disturbed state of mind upset the nicety of adjustment in attitudes and reactions, leading almost immediately to an accelerated accident rate.

The Influence of Mental Health Upon Employee Performance

Mental health affects not only accident rates; it influences directly the character of the employee's performance on other aspects of the job. This is well illustrated in a study, in a large department store,[1] of the personality characteristics of a group of 100 salespeople rated by supervisors as the BEST and WORST sales clerks in typical departments of the store. Ninety-four per cent of the WORST group and only 22 per cent of the BEST group showed some deviation from normal mental health. None of the sales clerks in the BEST group, and 24 per cent in the WORST group had serious personality disorders.

A Study of Telegraphist's Cramp

One other illustration may serve to show the intimate relation between disturbed mental health and adjustment to the job. Among telegraphists appears an occupational disorder known as "telegraphist's cramp," characterized by a violent and painful contraction of the muscles used in manipulating the key which completely disables the operator. Of 41 such cases examined by English investigators, 31 or 75.6 per cent showed (quite apart from the cramp condition) symptoms of mental disturbances characteristic of psycho-neurotics.[2] In 26 cases the symptoms tended to be of a serious nature.

These symptoms include a variety of *anxieties, obsessions* and *hysterias.* The man so affected is *never sure of himself —worries when he has done a thing as to whether it is right—complains of being watched in trains, buses or restaurants—goes back to make sure he has done what he thinks he has—likes to check his work many times—withdraws from games and social activities—doesn't feel at ease with people—is irritated and frightened by authorities—speculates on the possibility of such occurrences as the floor giving way or the building falling down—becomes upset by noises*—and so on.

Not only did 75.6 per cent of those suffering from telegraphist's cramp show such symptoms, but in the large majority of these cases they were of a serious nature. In contrast, of 46 telegraphists *not* affected by cramp, only 15, or 32.5 per cent showed signs of psycho-neuroses in varying degrees.

The Cost to Industry of Disturbances in Mental Health

Such disturbances in the mental health of workers not only create difficulties for

DR. MORRIS S. VITELES

This is the third of a series of articles on Medical Service in Industry, prepared by the Subcommittee on Health, of the Accident Prevention Committee, E.E.I., composed of: Dr. Hart E. Fisher, Chicago; Dr. Noel G. Monroe, Boston; Dr. J. J. Wittmer, New York City; Professor Morris S. Viteles, Philadelphia and Wills Maclachlan, Toronto, Ont., Chairman.

These articles will appear monthly in the BULLETIN *and will present different phases of the types of assistance that can be given to industry by the Medical Profession.*

The Subcommittee will welcome comments and discussion of these articles. These comments should be addressed to the

SUBCOMMITTEE ON HEALTH
Edison Electric Institute
420 Lexington Ave., New York, N. Y.

[1] V. V. Anderson, "The Problem Employee," *Pers. J.*, 7 (1928), p. 203-25.

[2] M. Smith, M. Culpien and E. Farmer "A Study of Telegraphist's Cramp," *Ind. Fat. Res. Bd. Report No. 43*, London, 1927, 44 pages.

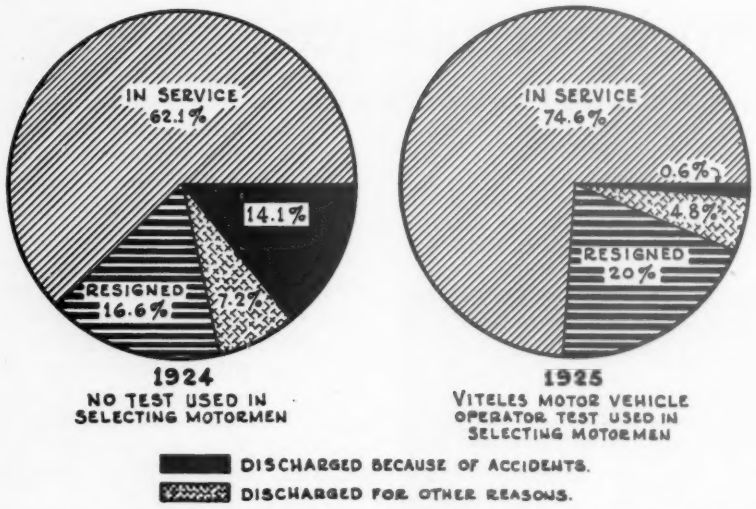


Figure 1—Tangible Results from the Use of Scientific Methods in Selecting Motormen. (The Milwaukee Electric Railway and Light Co.)

(Reprinted from M. S. Viteles, *Industrial Psychology*, W. W. Norton and Company, p. 296)

workers and supervisors; they add to the labor costs of industry. According to Fisher and Hanna, of New York University, who studied this problem, one-half of the amount annually expended by American industry because of labor turnover is spent on the replacement of workers suffering from maladjustments in mental health.[3] Assuming the average cost of breaking in a new worker to be $45.00, turnover cost alone in this group amounts to $11,250 for a firm employing an average working force of 2000 men with an annual labor turnover of 25 per cent. To this cost must be added losses from reduced output, the cost of excessive absenteeism, increases in the expense of supervision and other additions to labor costs which accrue when inadequate consideration is given to the mental health of the working force.

A 5-POINT PROGRAM FOR MAINTAINING THE MENTAL HEALTH OF EMPLOYEES

The frequency and effect of personality disturbances among employees call for an all-inclusive program for the *prevention, discovery* and *treatment* of mental health problems among employees. The following is suggested as a 5-point program for the electric utility industry. It calls for the co-operation of the line organization and specialized staff divisions such as Personnel, Medical, Employee Welfare, Safety, etc., in promoting improved employee welfare and performance through adequate consideration of psychological aspects of adjustment to work.

STEP 1–The Selection of Competent Workers

The first three steps in this program are *preventive* in character. Of these, the initial step calls for the use of suitable selection techniques to avoid the employment of men and women who become predisposed to emotional and allied mental disturbances because of unfitness for the jobs to which they are assigned.

The failure to make good on a job may easily lead to serious maladjustment for the worker. Those who by disposition are unqualified for a job remain inexpert and generally fail to meet the production standards of the job. As a result, they tend to be flustered, worried, annoyed and discontented. Annoyance, worry, and similar states of mind tend further to lower the level of performance on the job by introducing an erratic quality into response. Too much force is used; movements tend to become jerky and violent; dangers are ignored and risks are taken—with the result that the quality of work suffers, mistakes are made, and accidents occur. The flustered or worried worker also has difficulty in maintaining the serenity of mood required for good customer contacts, and complaints crop up to add to his difficulties.

Disciplinary or other measures imposed by supervisors as a result of poor performance tend further to accentuate the distressed state of mind. There is set up a vicious circle of "misfortunes" from which the worker appears unable to extricate himself. One end-result may be a permanent attitude of bitterness which poisons his outlook towards the organization. This, by a process of suggestion, may infect the workers around him. The final outcome may be a so-called "nervous breakdown" which, in many instances, is merely the end-effect of constant strain and jar on a human machine unsuited for the job to which it has been assigned.

Selective adjustment of workers at the time of employment therefore constitutes the first step in preventing the incidence of personality maladjustments. The techniques of selection cannot be discussed here, but they call for psychological tests and allied scientific techniques to supplement the medical examination, the interview, and other traditional procedures of the employment office. Experimental studies by the author and others, involving the use of such methods in selecting stenographers, motormen, overhead line apprentices, customer service representatives, electric substation operators, and workers for other varied jobs show not only direct results in reducing errors and accidents, of the type illustrated in Figures 1 and 2, but equally important indirect results in promoting the adjustment and continued good mental health of individual employees.[4]

STEP 2–Training the Worker

Selective adjustment must be followed by systematic training in the skills and knowledge of the job as a means of enabling the worker to make effective use of his ability. Proficiency, freedom from accidents, continued adjustment to the job can only be achieved if the worker is taught the best practices of the job and supplied with the technical information which he needs to back up his skills.

Accidents, it has been pointed out, are frequently associated with disturbances in mental health. However, the relationship operates in two directions. Maladjustment may be at the basis of an accident but, conversely, accidents also lead to over-wrought states of mind which leave the worker with a predisposition to still other accidents—with a sort of heightened "accident proneness." But, *the prevention of accidents is partly a matter of forming habits of careful workmanship. A man cannot possibly disregard safety when he is doing a job properly.* As Pepper of the Illinois Bell Telephone Company has pointed out,

[3] V. E. Fisher, and J. V. Hanna, *The Dissatisfied Worker*, Macmillan and Co., New York, 1931, p. 233-34.

[4] M. S. Viteles, *The Science of Work*, W. W. Norton and Co., New York, 1934, Chapter 5.

"the same slip of the screw driver which punctures the hand also mars the screw head, damages some other part of equipment, and indicates faulty or incomplete training—a poster proclaiming 'Work Carefully' will have little effect upon the work habits which have been continuously used for years. The key to efficient and safe workmanship is the continuous repetition, over and over, true to form, of correctly planned methods of work."[5]

The Problem of the Older Employee

The importance of *training as a device for preventing maladjustment* is particularly apparent in the case of older employees who constitute serious personnel problems in many organizations.

An investigation by Lillien J. Martin shows clearly that employers of the old charge them with being too slow in physical movement; too set in their ways. They resist the introduction of new methods and are difficult to teach even when they show a willingness to learn new methods. The old are talkative—even garrulous—and are too critical of both co-worker and employer. They look back to the past. This makes it difficult for them to make even the simple adjustments necessary for industrial progress.

The older employees also express themselves as dissatisfied with the industrial situation. They complain that the young are always shown preference—that they themselves are well able to do the work of industry but are discriminated against because of their age. This is only too frequently true.

The tendency in industry has been to limit training to new employees. This practice has created a condition in which groups of employees with relatively short periods of service often have more information, are more dependable, and are capable of functioning more efficiently than groups with longer service periods. This situation arises when the first group has been granted the benefit of systematic instruction not made available to the latter by the very reason of length of service.

Supervisors and personnel managers have discovered only too frequently that experience and length of service give no sure index of superior ability to perform on the job. There has been a failure on the part of experienced workers to keep pace with changing methods of work, partly by reason of stagnation on the part of the worker, but also, in many instances, because of failure to provide for such workers the opportunity for systematic instruction. These factors have forced upon supervisors and employment managers the embarrassing situation of having to lay off workers with 10, 15 or 20 years of service, because of inefficiency, or to retain them—for humane reasons—in spite of the loss forced upon a firm which could carry such an additional burden only with great difficulty.

[5] F. M. Pepper "Training from the Executive's Viewpoint." Report, 22nd *Annual Safety Congress, Public Utilities Section*, 1933, p. 396.

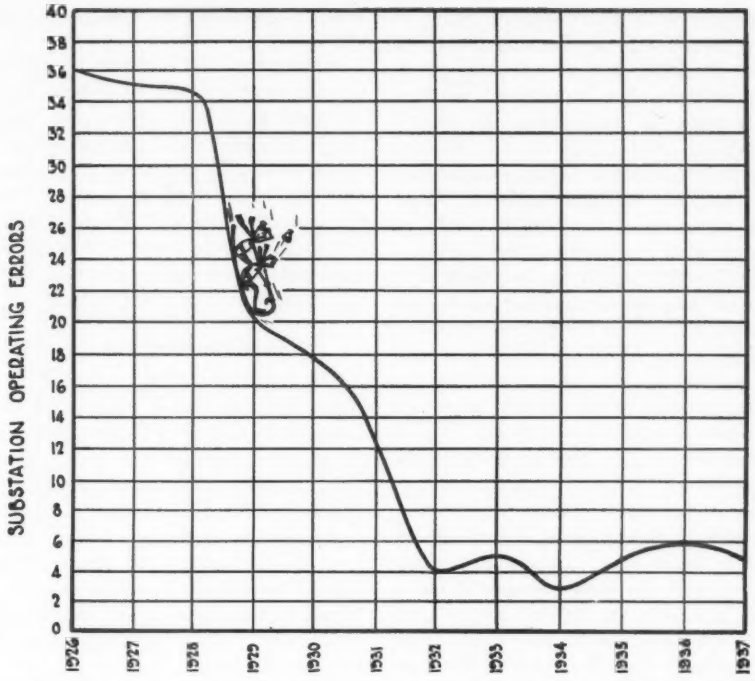


Fig. 2—Improvement in Operating Error Record Among Substation Operators, Following the Introduction, in 1928, of Tests Developed by the Author for the Selection and Placement of Electric Substation Operators (Philadelphia Electric Company)

(Reprinted from M. S. Viteles, *The Science of Work*, W. W. Norton and Co., p. 145)

Many reasons have been given for this neglect of the men already on the job. The first is the "apparently obvious" reason that experienced men need no training—that experience itself more than counterbalances the advantages of systematic training. Perhaps equally frequent is the excuse that men on the job cannot be taken from their work for instruction purposes. Added to these is the widespread conviction that learning ability deteriorates rapidly, and that the instruction of men beyond their prime (with "prime" placed somewhat around the forties) is therefore subject to little return in the way of proficiency. Other reasons are also given, such as the fear of resentment on the part of experienced employees submitted to an instruction program, the cost of personnel employed in the administration of an all-inclusive training program, etc.

The belief that learning ability deteriorates rapidly among adult workers has received a severe blow. Recent studies of adults have shown that such difficulties as the older worker may have in learning improved methods of work follows not primarily from a decline in learning ability but from an atrophy of acquired learning habits as a result of disuse. Experience also has shown that the difficulty of fitting training time with working time is far from insurmountable. Operating costs for the instruction of experienced workers can be kept within reasonable bounds. There is also definite evidence that there is no resentment on the part of older workers to instruction. Resentment simply does not exist where employees are completely informed of the purpose of the training program, and where, as is true in organizations with sound personnel policies, workers possess confidence in the integrity of the management.

Training as an Aid to Transfer of Older Employees

Personnel problems created by the depression and by technological changes,

combined with the changing point of view concerning the learning ability of older workers, lend new importance to the instruction of experienced workers as a means of maintaining the mental health and productivity of older employees. Industry may maintain its efficiency by scrapping the older worker. To do this represents a sacrifice, not only of the sense of responsibility for the individual worker which has become a vital part of the progressive industrial organization, but also of the proven reliability and accumulated experience of men with long years of service. Provision for training becomes particularly important in times of economic depression, when it is necessary to shift personnel within the organization so as to retain employees with long years of service.

Such training involves, *first* of all, the instruction of each employee in the best practices of the job he is now holding, and, *secondly*, instruction in the principles and practices of the job to which he can most easily be transferred in case of the replacement of his job by machines, of changes in company practices, or of temporary economic depression.

The application of this policy may mean, for example, that meter readers in an electric and gas utility will be trained not only in the approved practices of meter-reading, but will also receive detailed instruction in the work of the bill collector, the job to which meter-reading is related most closely on the organization chart. Ground men in line construction and maintenance gangs will be taught not only pole-setting, but splicing, transformer installation, and even trouble-shooting, in order to provide greater mobility of the individual and of the crew under varying conditions. D.C. station operations will be taught the principles and practices of A.C. operation as a step in adjustment to prospective change-over from one to another. Employees in traditional coke gas-making plants will become acquainted with the reformed oil process, in preparation for the day when a shift in operating practice may be found necessary, etc. That this is a practicable program has been demonstrated in the work of a number of organizations, such as the Philadelphia Electric Company, which have formulated such training plans as an aid in transferring to available jobs employees who would otherwise be dropped from the payroll.[7]

[7] M. S. Viteles, "Employee Training," U. G. I. Circle, March, 1933.

[8] H. Feldman, "Problems in Labor Relations," Macmillan & Co., 1937, p. 177-79.

STEP 3—Improving the Quality of Supervision.

Among the chief factors in maintaining the mental health of the worker is the *quality of line supervision.* Both every-day observation and psychological investigations in the plant have shown that the same group of workers, with the same pay and with the same equipment will produce more, be better satisfied, and remain better adjusted under one supervisor than under another.

Supervision Affects Efficiency

The influence of the quality of supervision upon output is illustrated in a study in an insurance company reported by an economist attached to the Amos Tuck School of Administration and Finance of Dartmouth College.[8]

Among the employees of this company were approximately 1000 clerks, divided into 22 sections, doing uniform work in issuing policies, taking care of lapses, revising old policies and providing for transfers of policies.

In 1933, a new plan providing for group incentives to the 22 sections was inaugurated. Costs for each section for the previous 12 months were computed and each was allowed a group bonus on the savings it could effect over the cost of that period. All members of a section, including the supervisor, were to share in these savings monthly on the basis of salaries, no change being made either in the basic salary or in established policies with respect to salary increases. There was no competition among the sections, the "bogey" being each section's own record for 1932.

At the end of 1933 every section showed some improvement, but the extent of improvement ranged from 2 per cent to 12 per cent, with an average of 8 per cent. These differences among sections led to considerable discussion.

"Some supervisors, whose sections had shown small reduction in costs," writes Feldman, "took the position that they already had such a near-perfect condition of morale and efficiency that very slight improvement could be expected at best, and that therefore the higher bonus earned by some other departments was an unjust reward for past inefficiency. Another group of supervisors explained the disparity by pointing to differences in working conditions, or to an inherently poorer grade of employees. A supervisor would say: 'Oh, yes, if I had Section X and its group I could have made just as good a showing or better. But Supervisor X should try a hand with the green hands and numbskulls in my department and we'd see how much of a bonus there would be!'"

To overcome these criticisms, management, in 1934, effected a general shift of all section heads, with the general aim of putting those who had been in charge of above-the-average bonus groups into those less-than-the-average sections. This transfer also gave an opportunity to determine whether differences in results were related primarily to differences in supervision or to differences in personnel or conditions of work.

At the beginning of 1935, the production results of the 22 sections were again compared. In this section comparison the lowest saving was 6%, the highest 18%. In other words, the general rate of improvement had been raised, but "the striking fact was that, in progress made, the order of the supervisors remained practically the same. The previous leaders were still the leaders; the laggards were still the laggards. *Changes in relative order were limited to three cases of supervisors who had moved a step or two."*

Supervisors rating low in the list still complained that the changes made had benefited some supervisors and handicapped others. The old complaint recurred, "If Supervisor Y had my section" . . . . As a result, early in 1935, the management met the situation a third time by shifting, by lot, 20 of the 22 supervisors. "Although they were thus reassigned by chance, the listing at the end of the year showed the surprising result that in progress made the same general order of supervisors again prevailed." *Moreover, an analysis of errors in terms of 1935 and 1936 earning records showed perfect correlation between the standing of the accuracy record of the work of each section under a supervisor and the standing on the earning record.*

Supervision Affects Morale and Mental Health

The implications of this practical experiment in supervision are clear. Not only output, but the quality of work depends in large part upon the character or quality of supervision. Moreover, the importance of good supervision does not stop here. In modern industry the worker is largely dependent upon his supervisor for his job and for progress in the organization. This dependence intensifies his emotional reaction to good and bad supervision. Whenever the junior executives creates a wholesome, healthy atmosphere, in the plant, he in-

fluences favorably the mental attitudes and emotional stability of the worker. When he creates an atmosphere of tension, irritation and distrust he creates unhealthy attitudes and reactions. In this way he wields a power that affects —for better or for worse—the mental health of those working under him.

This is so because the workman's contact is primarily with the foreman or supervisor who represents to him the "company" for which he is working. Beyond the foreman and intermediate supervisors are the major executives—a something vaguely known as management—a far-off power which he comprehends but dimly. The realistic and immediate element in the worker's daily life is the foreman or supervisor who interprets the policies and administers the practices formulated by management. In the long run, the morale and the mental health of the working force stand or fall not by the policies or practices established by major executives, but by the way each is interpreted and administered by first line supervisors and foremen.

Training in Supervisory Techniques

The question that naturally arises from this discussion is how to improve the quality of supervision in industry. One major step in this direction is that of training supervisors in sound practices of supervisory control. In handling men and women—as in manual and office jobs—there are good and bad methods of work. There seems to be a widespread notion that supervisory technique is a matter of a "sixth sense," an "intuitive faculty" which defies explanation—a "hunch" that tells what is the right thing to do at the right time. Actually, in most instances the "intuition" or "hunch" represents a display of unguided emotional impulses. It is really a failure to "think through" the problem arising in particular situations where men are to be handled.

Supervisors must be taught to marshal fact-finding, analysis, and reasoning in promoting the effective use and protection of man-power—in developing supervisory practices which produce results in the way of production without jeopardizing the mental health of the worker.

Experience has shown that this type of training can best be carried on through the conference method, where supervisors meet to discuss various aspects of their task under the direction of a qualified leader. The most satisfactory material for such conferences are case studies or sample problems, of the type illustrated in *Exhibit A*, arising directly in the course of the work of the supervisory force. The writer's practice, as employed in a supervisory training course now in operation in the Philadelphia Electric Company, has been to use problems actually presented by those enrolled in the training course, with modifications in the description designed to conceal the identity of the worker, the supervisor and the specific unit involved in the situation furnishing the basis of the case problem.

The discussion of such case problems in a supervisory training program promotes an exchange of experience among supervisors that has proven extremely helpful in improving supervisory techniques. Such discussion helps the supervisor to see employees and their problems in their proper perspective. It encourages even the old-fashioned "hard-boiled" foreman, the domineering autocrat of the workshop, to recognize the personality of the individual worker, to search for the underlying factors which influence the performance and attitudes of employees; to develop insight into the mental adjustments of individuals; to acquire skill in influencing and directing them to obtain the best results in performance and continued adjustment to work. Such an approach serves not only to further the welfare of individual employees and to eliminate many grievances at their source, but to strengthen employee morale; foster favorable attitudes; promote the broader objectives of the industrial relations program.

STEP 4—The Discovery of Problem Employees

The emphasis, so far, in the discussion of mental health problems in industry, has been upon *prevention*. An all-inclusive program will concern itself not only with prevention, but also with the *discovery* and *treatment* of employees who, in spite of all that is done in the way of prevention, still develop disturbances of mental health.

EXHIBIT A

Sample Case Problems from Philadelphia Electric Company Supervisory Training Program

1. Complaints have come to you about one of the men in your organization who has charge of handing out material in the Stock Room. The complaint is that he is "grouchy" and that he does not cooperate with the men who come to the window for material.

A. How would you go about handling this situation?

B. Suppose that, as a result of an interview with this employee and of further investigation you reached the judgment that he possessed the characteristics listed below. How would this information help you in handling the problem?

Characteristics

Appears to be underweight.
Does not look one straight in the eye when talking.
Does not seem to mix much with other people.
Pasty complexion with deep shadows under the eyes.
Seems worried about conditions at home.
Appears to be slow moving.
Seems eager to please.
Seems nervous.
Has had two years of high school.
Is working in evening courses at a business school.

* * *

2. *A supervisor writes:* "A man was hired about 15 months ago to work on refrigeration service in one of our suburban divisions. He attended our refrigeration service course in Philadelphia for 6 months and during that time worked in the field with the older service men. At the expiration of that time he was sent to the suburban division and worked in the field, alongside of an experienced man, to gain more experience and to become familiar with the territory.

"This man appeared from the start to be well adapted for the work. He would impress you as being a 'pretty intelligent fellow.' For this reason we were led to believe that he would make a good serviceman, so he was sent into the field alone.

"Instead of turning out as we thought he would be, very quick to analyze trouble, he is the reverse. For example, his orders came through with the request that the jobs be checked. In most cases this should be unnecessary, as the man should be capable of making a correct analysis of the trouble and also be sure of the repairs.

"For example, he was sent on a refrigerator complaint and after he arrived on the job he called the dispatcher and said that it would have to have a new motor. The storeroom did not have the proper size motor. While explaining the job to the dispatcher the serviceman said he probably could make a brush rig and a set of brushes do. The next day, when the sales order came through we found, that all the material that was necessary to repair the job was a set of brushes, and the time spent on this job was 2½ hours of overtime. This man has been reprimanded several times and shown his mistakes. He seems to become very much disturbed when criticized, but it doesn't appear to do much good."

What further action can you suggest in this case?

What factors must the foreman consider in handling such a problem?

EXHIBIT B

Portion of a Periodic Rating Scale for the Discovery of Outstanding and Problem Employees Performance Rating Record

Last Name | First Name | Initial | Address | Payroll Number

Sex | Date of Birth | Marital Status | Position

District or Division | Section or Group

Name of Person Doing Rating | Position | Reviewer | Date

INDUSTRY	Consider whether the employee regularly applies himself to the job, keeps busy without wasting time	Excellent	Good	Fair	Unsatisfactory
SPEED OF WORK	Consider the amount of work accomplished, i.e. output in relation to established standards, or time consumed.	Excellent	Good	Fair	Unsatisfactory
QUALITY	Consider the accuracy of work, orderliness, and thoroughness in completing all details.	Excellent	Good	Fair	Unsatisfactory
KNOWLEDGE OF JOB	Consider familiarity with the duties of the job and allied knowledge necessary for its performance.	Excellent	Good	Fair	Unsatisfactory
COOPERATION	Consider success in getting along with fellow workers and supervisors, and in tying in with other departments.	Excellent	Good	Fair	Unsatisfactory
APPEARANCE	Consider personal cleanliness, neatness of clothing, physical characteristics and mannerisms.	Excellent	Good	Fair	Unsatisfactory

EXHIBIT C

Portion of a Periodical Rating Form for the Discovery of Outstanding and Problem Employees

ANSWER ALL QUESTIONS BELOW FULLY:

1. How do you rate this employee in terms of his general value as a member of your group?

   As Outstanding - (the best, or one of the best workers you have ever supervised or known on his job.)

   As Very Satisfactory - (above average performance in every respect)

   As Satisfactory - (an average employee, well fitted for the work he is doing)

   As Problem - (of any kind, due to poor health, lack of ability or failure to use it, difficulty in getting along with other employees or the public, or any other cause.) (Indicate by underscoring and add such supplementary explanation as necessary.)

2. List below strong points, difficulties or faults, and activities (Educational, Social, etc.) on or off the job which have a bearing on this employee's performance or advancement with the Company:

   Health

In every industrial organization, no matter how progressive the personnel practices may be, maladjusted workers are to be found. Some of these are employees with tendencies to emotional maladjustment who pass through the Employment Office and for a time succeed in maintaining themselves *en rapport* with the job, the supervisor, and their fellow-workers. A second group includes workers with inherently stable personalities who have been brought to a point of maladjustment by stresses and strains occurring on or off the job. Another group of maladjusted workers consists of those who are essentially not adapted for the job from the point of view of abilities but who for a period of time manage to "get by". These are frequently uncovered by change in supervision or by the imposition of more exacting production standards. In addition, changing conditions of work help to induce maladjustment among older workers and others who through the disuse of their learning ability, etc., are unable to adapt themselves to new methods, new ways of working, new machines that are introduced in connection with technological changes in industry.

The rehabilitation of such employees calls first for the early discovery of every worker who shows signs of becoming a problem. This means that the supervisor must continually be on the alert for signs of disturbed adjustment, such as reduced efficiency; growing irritability and laxness in work; a multiplication of complaints, exaggerated concern by the worker about himself or his work, etc. *The discovery of problem employees is facilitated by a system of periodic rating* which requires the supervisor or foreman to prepare at stated intervals a report on the employee's progress, of the type illustrated, in part, in *Exhibit B,* which has been successfully used by many organizations for this purpose. A general rating of the type shown in *Exhibit C,* included on such a report, has been found helpful by a number of companies not only in earmarking promising, outstanding employees, but also in discovering problem employees before it is too late for them to profit from a reasonable and practical program of rehabilitation.

STEP 5–The Treatment of Problem Employees

The final step in this 5-point mental health program calls for the treatment of workers, especially those with a reasonable period of service, who become maladjusted. This involves a thorough analysis of all the factors—medical, psychological, social and economic which influence the worker's adjustment. Such a study may require the application of the specialized techniques of the physician, psychologist, and the social worker; representatives of the staff of the Personnel Department, who in conjunction with the line organization, formulate a plan of rehabilitation suited to the cause of the maladjustment. Particularly important to the success of such a plan, which may involve transfer, or leave of absence, or special treatment of some other sort, is the co-operation of the line organization.

Resistance against such programs which at times appears in portions of American industry reflects the failure to appreciate the dollars-and-cents aspects of the mental health problem. Industry has learned that it costs money to replace oil, scraps of iron, pieces of wood, and the by-products of manufacturing which in past years were thrown out as waste, but which are now salvaged. Industry as a whole has not yet learned that it likewise costs money to replace the human material that can likewise be salvaged through the use of techniques appropriate for this purpose. There is no question that the adjustment of the problem employee while continuing at his work can result in an enormous saving in employment, training, and placement of new people. More important still, the individual problem worker becomes of some satisfaction to himself as well as to others, an asset not only to business, but to the community at large. In this way, industry contributes not only to its continued well-being, but to the prevention of work failures which later result in social problems that become the burden of the general community.

Going Forward with Coordinated Promotion

By C. E. Greenwood
Commercial Director, E.E.I.

THE recession period is being registered in energy output figures. For a second time in five years we experienced a rapid drop in industrial load; unemployment is rampant; there is a drop in general merchandising sales with resulting economy in electric use on the part of the merchant. Yet we do not expect the low points of previous set-backs because there has been a process of educational influence on the consumers of electricity, making them more sensitive to the social and economic value of the service.

Since the low point of mercantile and industrial use in 1932 and 1933 the commercial forces of the industry have been forging ahead with the full power of sales coordination with other interested groups to build the domestic load. We can sell industrial improvement best when machines are humming to productive capacity. Therefore the urge at present for intensive application in more fertile fields.

Are we organized? Yes, perhaps most readers of the BULLETIN have seen periodic reports in these columns of the promotional achievements of the Better Light-Better Sight Bureau, the Water Systems Council, the Modern Kitchen Bureau and the Commercial Electric Cooking Council. How will these function the coming year? What other services will be intensified and what other opportunities for stemming the tide of receding energy sales present themselves? A brief review is all that can be presented in these columns. Each coordinated program has its own Plan Book with a guide to action.

BETTER LIGHT - BETTER SIGHT—
M. E. Skinner, Chairman

The first national program sponsored by the Institute to be sustained over a five-year period is Better Light-Better Sight, now a by-word in the industry. But to its dynamic and capable Chairman, the Executive Committee of the National Bureau and hundreds of active company supporters, it has been interpreted as a powerful, social and educational force which has gone hand in hand with the economic aspects and has given new value to the service of electric lighting in homes, and in commercial, public and industrial structures.

Although developments within our own industry are well known it will be helpful to review what two or three other leading industries have done by way of coordination. The introduction of light prescribing technique for the optical practitioner and the extensive advertising and promotion of some of the major electrical interests in advocating eye examination along with Better Light for Better Sight have caused literally thousands of refractionists throughout the country to have a better understanding of the relationship of adequate lighting for eyesight protection and a very great many of them are making definite recommendations to their clients for adequate and proper lighting.

Outstanding in this respect has been the development of active interest and participation by members of the medical fraternity and ophthalmologists. A great deal has been written by these authorities referring to proper lighting as an important factor in good seeing and in this respect the high-light of recent activities was the address of Dr. Morris Fishbein, Editor of the *Journal of the American Medical Association,* at the Edison Institute Convention last year. The Bureau alone has distributed over 100,000 copies of this address throughout the country and the impression made by that talk on the medical group has been quite marked. In *Hygeia,* the health publication of the A.M.A., a series of six articles by eminent medical authorities is now being run. This publication, widely read by the medical fraternity, educators, school teachers, etc., is accepted as containing authentic information without question. This series of articles is expected to be most effective and fruitful in further acceptance of Better Light-Better Sight. Reprints of these articles are made available by the Bureau and to date over 200,000 copies have been distributed throughout the country.

As to the paint interests, there is one accomplishment that, we believe, is outstanding. Prior to the participation of the paint group in the Program it was common practice for that group in their advertising promotions and sales efforts, to play down electric light—featuring the merits of their products in order to cut down light bills. Since participating in the program, we have been able to influence a large number of the paint group, particularly the manufacturers, who now refrain from using "save on your light bills" as a sales argument, and many are selling better seeing conditions and eyesight conservation in the effort to sell their product.

All classes of lighting in the electrical industry have been extensively promoted and it is conservatively estimated that between twelve to fifteen million dollars have been spent in promoting Better Light for Better Sight.

One special accomplishment has been the introduction and sale of IES Better Sight lamps. To date over 3,000,000 lamps equipped with certification tags have been sold and it is estimated that an equal number of the same type of lamp has been sold without tags. These lamps have definitely influenced the lighting in homes to a higher standard and quality. They have also influenced higher standards of illumination in the commercial and industrial fields and in the schools.

A measure of the extent of advertising and promotional material produced, sold and distributed by the Bureau since its inauguration is indicated by a review of the records. Approximately 500,000 copies of *Better Light-Better Sight News* have been distributed; over 1,000,000 educational type booklets, folders and reprints and 315,000 commercial type booklets; 14,000 window and counter cards; 3,800 copies radio continuities; 3,600 copies of playlets and skits; 3,000 billboards and small posters; 5,000 newspaper advertising mats; 2,200 large exhibit display pieces; 7,500 general reprints from various publications and other items.

If inquiries and requests for information mean anything at all, the great mass that the Bureau alone is constantly receiving from educators, welfare societies, parent-teacher groups, etc., indicates that the Better Light-Better Sight message is making real progress and that

there are millions of people more light conscious than ever before.

RUNNING WATER—
H. E. Dexter, Chairman

Another joint program of manufacturers and utilities now in its fifth year is the Running Water Program of the Electric Water Systems Council. It is recorded with regret that P. H. Powers of West Penn Power Company, Pittsburgh, who has headed this movement since its inception was obliged to relinquish the Chairmanship. An ardent and earnest member of the Council, H. E. Dexter, has been chosen as leader.

If anyone should question the potential power of national and local coordinated advertising and selling he might look at the records of sales of electric water systems in the United States coincident with the activities of the Council. The record shows that in 1933, 57,000 units were sold; in 1934, 77,000 units; in 1935, 108,000 and in 1936 the total amounted to 154,000. The three-year plan was completed. The cooperating manufacturers said our work is not half done. We should go forward for another five years. In 1937 the output was 190,000 water systems. Chairman Dexter places the quota this year at 250,000.

New members on the Council are C. H. Leatham, Monongahela West Penn Public Service Co., Fairmont, W. Va.; J. S. Webb, Philadelphia Electric Co., Philadelphia, and C. G. Glueck, Ebasco Services, Inc., New York City.

The 1938 Plan Book carrying full details is ready for the printer as the BULLETIN goes to press. A new consumer booklet, *Running Water,* will be furnished gratis to utility companies distributing them to prospects. A window card designates *Active Member;* the sound slide film, *Life in the Country,* will be given wider distribution.

Now comes a return of Title I of the National Housing Act with its modernization phase which places water systems and drilling of wells in the list of items eligible for insurance under financing plans. Therefore a broadside of information which constitutes an effective selling piece for the consumer is being prepared for distribution.

The Council anticipates the water system will be given a prominent place in the load building efforts of the utility.

THE MODERN KITCHEN BUREAU—
G. E. Whitwell, Chairman

The keen and enthusiastic leadership of G. E. Whitwell has brought this program to a point of wide expansion in 1938. From an educational background this new approach to the sale of electric kitchen equipment is now advanced to the product stage with three distinct subactivities by manufacturer groups, all coordinated under the banner of the Modern Kitchen. A promotional fund has been appropriated by manufacturers to carry on this work. It has been proved that the Modern Kitchen "idea" can sell electric kitchen equipment. A recent report indicates that 25,647 electric kitchens, with two or three major pieces of electrical equipment, were sold in 1937 through the activity of but 23 local Bureaus. The Bureau will continue to merchandise the idea and correlate local activities. The Electric Water Heater Division has donated a fund for a series of prizes for both utility companies and individuals and aimed to emphasize the importance of electric water heater service in the load building scheme of the activity and to inspire salesmen to more productive sales results.

The electric refrigeration campaign will be conducted as a series of local activities over the year.

For the first time we will see in leading women's publications—*Woman's Home Companion, McCall's, Ladies' Home Journal, Good Housekeeping, The American Home, Better Homes and Gardens* and others in April and May—effective advertising directed to break down the fundamental obstacles in selling. A complete merchandising program is built up for a local tie-in with this national advertising campaign. An outstanding feature will be the "National Electric Range Spring Showing" to be held from April 11 to April 30. During this period utilities and local Kitchen Bureaus will be urged to cooperate in conducting local shows, cooking schools and local newspaper advertising. A series of newspaper advertising mats are available nationally.

Panels announcing the "Spring Showing," radio continuities and other promotional material for local Bureaus have been prepared.

Another important feature will be the window display contest for utilities, department stores and dealers with $400 divided into 13 prizes. The first prize is $150, second prize $100, third prize $50 and ten prizes of $10 each.

The electric range is the keystone of the all-electric kitchen. The national advertising will feature its speed, economy and cleanliness together with other advantages of control, time release and beauty.

On to Chicago!

Fifth Annual Sales Conferences

EDISON ELECTRIC INSTITUTE

MARCH 29 - APRIL 1

Edgewater Beach Hotel, Chicago, Ill.

4 General Sessions
1 Session Modern Kitchen and Equipment
1 Session Better Sight and Lighting
2 Closed Sessions on Power Sales
Round-Table Conference on DEALER COORDINATION
Committee Conferences

Nationally known speakers.
A week of Information and Education.

Plan NOW to attend

COMMERCIAL ELECTRIC COOKING COUNCIL—P. M. Alden, Chairman

Organized in the Fall of 1937 and just getting its feet on the ground is the Commercial Electric Cooking Program, another activity sponsored by the Institute jointly with NEMA. It is organized to revive and sustain interest of the utility in the counter and pantry items of commercial cooking equipment. In studying the potentialities in the commercial field for future load building there is no field that offers more encouragement. Here are useful devices for the restaurant and hotel owner offering a reliable service and readily salable. More trained sales power for the job will be a profitable investment. The Council points out in its Plan Book what the commercial executive wants to know. It offers two mailing pieces which have been tried in the field and have proved effective business getters. Samples have been sent to executives of all leading utility companies and orders are solicited. The complete survey of the market is now in progress and a scheme of publicity is planned for the year.

ADEQUATE WIRING—
W. E. Spracklin, Chairman

The need for a National Program designed to educate the public, builders and architects to the many advantages of adequate wiring in homes, has been generally recognized by the electrical industry. Now a program broad in scope has been developed over a period of more than a year through cooperative effort of all branches of the industry. It is formally launched with W. E. Spracklin, Vice-President Anaconda Wire and Cable Company, as Chairman and M. E. Skinner, Vice-President Buffalo Niagara and Eastern Power Corporation, as Vice-Chairman. Funds for the national promotion and field activities are supplied by the National Electrical Manufacturers Association and Headquarters are in the office of NEMA. The Institute has endorsed the objectives of the national program and on the Executive Committee the Institute has two members. C. A. Eastman, Ebasco Services, Inc., New York City, serves in addition to Mr. Skinner.

A general Plan Book covering the national program has been published which describes the purposes of the plan, methods of operation, and illustrates all promotional materials. These Plan Books are now being distributed. The national plan is basically one of general education and sales promotion. For those who wish a supplemental program along the lines of Red Seal promotion, there is a Certification Plan Book available upon application.

The national slogan is ADEQUATE WIRING SERVES AND SAVES.

It is of particular interest that the national specification for adequate wiring is based on the Residential Section of the *Handbook of Interior Wiring Design*. Field service will be available from NEMA Headquarters to assist local groups and others tying in with the national program.

Utilities Will Help in the New Housing Program

ECHOES of congressional speeches at Washington and newspaper headlines have whetted interest in the potential power of the National Housing Act Amendments to revive home building and inject a stimulant into the construction industry. The signing of the Bill, and initial stimulation under its provisions, find quick response from contractors, builders and architects and hundreds of communities ready to go. The harvest is to be reaped from those in the wage earner class and the white-collar men who are stable in employment and wish modest homes of their own.

Pointing out some features of the Amendments, the Construction and Civic Development Department of the United States Chamber of Commerce states:

"The new legislation provides for 90 per cent insured mortgages on newly constructed small homes which cost $6,000 and less, and for between 80 and 90 per cent insured mortgages on newly constructed homes which cost between $6,000 and $10,000.

For a limited period, until July 1, 1939, the new legislation reduces the insurance premiums on small homes from ½ to ¼ per cent. It eliminates entirely the existing annual service charge allowed the lender of ½ per cent on the face value of the mortgage, and further reduces the costs of insured mortgages by figuring insurance premiums on the reduced balances, instead of as at present on the face value of the mortgage. It is contemplated that these new premium arrangements will reduce the cost of insurance of mortgages from about 6.4 per cent to 5½ per cent, with a special provision for reduction to 5.25 per cent in case of houses costing $6,000 or less and insured before July 1, 1939.

On newly constructed houses appraised at $6,000 or less, the minimum permissible down payment or equity requirement will be reduced from 20 to 10 per cent. Thus, on a $6,000 newly constructed house, the minimum down payment would be $600 and the maximum insurable mortgage would be $5,400, representing 90 per cent of the appraised value.

On newly constructed houses appraised at $10,000 or less, the insurable limit will be 90 per cent of the appraised up to $6,000 plus 80 per cent of the appraised value above $6,000. For example, on a newly constructed $10,000 house the minimum down payment would be $1,400 and the insurable mortgage limit would be $8,600. On all other homes housing from one to four families, the insurable mortgage limit will remain at 80 per cent of the appraised value, but not in excess of $16,000 under any circumstances.

Provision is made for 80 per cent insured mortgages on newly constructed apartment buildings, or a group of not less than ten single-family dwellings, provided mortgages are in excess of $16,000, but not in excess of $200,000 or $1,150 per room. This is an entirely new provision. It should not be confused with the existing section of the law which provides for insurance of mortgages on large-scale rental housing projects owned and managed by limited-dividend corporations, which undertake to safeguard the investment by careful attention to factors of location, construction, maintenance, and continuing management. Various technical changes are made by the new legislation with the purpose of inducing both equity and mortgage funds into both types of development."

Commercial men in the electric utility have a definite stake in this new home building movement. The utility is dependent ultimately on the growth of the communities it serves for its own expansion. More owned homes and more employment mean a better community living and greater use of electric service.

But opportunity does not end there. There is the commercial motive which suggests promotion of Title I. The Modernization phase of the Housing Program returns again minus inclusion in the Insured List of equipment which is not a part of construction. However the built-in electric kitchen, wiring, lighting fixtures, air conditioners and water systems are acceptable for insured loans. Unfortunately electric refrigerator terms were made so easy when the former Title I was operative that the

(*Continued on page 72*)

Domestic Electric Appliances in 1937

THE year 1937 set new high records in the sale of many types of household electric appliances. While the electric refrigerator once more led the field with sales of 2,369,025 units (as compared with 2,079,535 the year before) conspicuous progress was made by the electric range and the water heater.

According to preliminary figures, the use of domestic electric service in 1937 totalled 17,820,000,000 kwhr, an increase of 2,161,000,000 (or 14 per cent) over the 15,659,000,000 sold in 1936. On a per-customer basis, this averages 805 kwhr, or 9½ per cent more than the 735 kwhr calculated on the same basis for the previous year.

The accompanying table shows the estimated use of electricity by the principal domestic appliances during the past year and the results since 1920 are shown graphically by the chart.

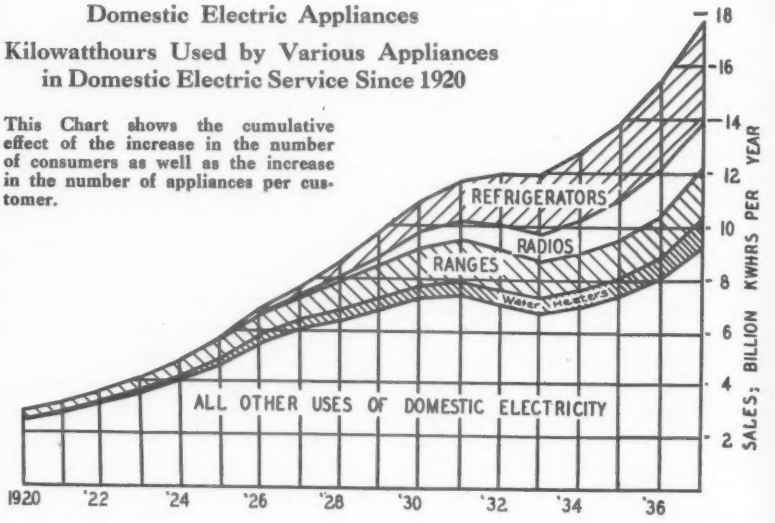
Some changes have been made in the averages covering the "normal" annual electrical use of several of the appliances. The average for the refrigerator has been reduced from 450 to 420 kwhr and that for the electric range from 1,350 to 1,200. On the other hand, the large proportion of sales of the storage type of heater has occasioned the increase in kwhr used by water heaters from 3000 per year to 3,300.

The largest numerical gain is shown by "Lighting and Miscellaneous Uses" which has grown from 262 kwhr per customer in 1936 to 288 kwhr in 1937, or by 10 per cent. The largest relative increase is that shown by roasters, which class of appliances has doubled its use of energy during the year.—*W. M. C.*

Domestic Electric Appliances

Kilowatthours Used by Various Appliances in Domestic Electric Service Since 1920

This Chart shows the cumulative effect of the increase in the number of consumers as well as the increase in the number of appliances per customer.



ENERGY USED BY DOMESTIC ELECTRIC APPLIANCES (a)

An Estimate for the Year 1937

Appliance	Approximate Number of Appliances in Homes				Kwhr per year per Appliance, Normal Use	Per Cent in Normal Use	Effective Kwhr per year per Appliance	Total Kwhr Used in 1937
	On Dec. 31, 1936	On Dec. 31, 1937	Saturation	Average 1937				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lighting and miscellaneous uses	.....	.....	.....	(per customer	288 kwhrs)	.....	.....	6,365,825,000*
Refrigerators	9,200,000	11,300,000	50%	10,250,000	420	90	375	3,843,750,000
Radios (socket sets)	21,750,000	23,750,000	106%	22,750,000	100	80	80	1,820,000,000
Ranges	1,450,000	1,775,000	8%	1,612,500	1,200	85	1,020	1,644,750,000
Flatirons	21,750,000	23,100,000	103%	22,425,000	80	80	64	1,435,200,000
Water heaters (all types)	432,000	528,000	2%	480,000	3,300	75	2,500	1,200,000,000
Oil burners	1,175,000	1,360,000	6%	1,267,500	250	95	237½	301,050,000
Washing machines	10,300,000	11,050,000	49%	10,675,000	30	80	24	256,200,000
Vacuum Cleaners	10,575,000	11,175,000	50%	10,875,000	24	85	20	217,500,000
Toasters	10,250,000	10,500,000	47%	10,375,000	30	50	15	155,625,000
Electric Clocks	10,300,000	11,500,000	51%	10,900,000	15	95	14	152,600,000
Ironing Machines	1,175,000	1,315,000	6%	1,245,000	125	80	100	124,500,000
Percolators	6,000,000	6,000,000	27%	6,000,000	36	50	18	108,000,000
Space heaters	4,500,000	4,750,000	21%	4,625,000	50	40	20	92,500,000
Roasters	375,000	650,000	3%	512,500	250	80	200	102,500,000
Total Appliances	.....	.....	.....	.....	.....	.....	.....	11,454,175,000
Total Domestic Service (old series)	.....	.....	.....	per customer	805 kwhrs)	.....	.....	17,820,000,000*

*Preliminary figures. (a) "Residential" plus "Farm" Service less Irrigation.

Notes: Columns (1) and (2): Estimates largely from ratios shown in "Electrical Merchandising" and other trade papers; being based upon the summation of annual sales of appliances less an estimated replacement demand.
Column (4): The arithmetical average of columns (1) and (2). Column (6): An estimate allowing for duplicate and unused appliances, houses unoccupied, summer cottages, vacation periods, etc. Column (7): The product of Columns (5) and (6) representing the actual kwhr per year per average appliance in the home. Column (8): The product of Column (4) and Column (7).

Use of Creosoted Poles By Power Utility Companies

By L. G. Smith

Chairman, Timber Products Subcommittee,
Transmission and Distribution Committee, Edison Electric Institute

Excerpts from a paper presented before the American Wood-Preserver's Association, Chicago, Jan. 19, 1938

As a result of several years' work on the part of an Edison Electric Institute Committee and the greatly appreciated cooperation of the Chairman of Committee 5-5-1 of your association, an agreement was reached on a specification for the creosote treatment of southern pine poles with which the interested Edison Electric Institute Committee is in accord as a specification denoting progress. This does not mean that we do not hope for something better in the future. Some concern has been expressed by some of our member companies regarding western red cedar poles. An investigation is being made now regarding troubles with this species of poles.

Requirements for Poles Before Treatment

The requirement for a long life pole is two-fold: namely (1) the pole must be sound and without serious defects prior to treatment, and (2) the treatment must be adequate. If the pole in the white possesses defects such as decay, which may be in the interior as well as on the exterior, or holes, obviously unsatisfactory life will be obtained in spite of the quality of the treatment. Likewise incipient decay, injurious checks, shakes, splits, insect damage or bad knots by preventing adequate treatment, by permitting decay to occur after installation of the pole, or by reducing the strength of the pole, may necessitate replacement of the pole in the early years, after its installation. A survey of the practice of member companies was conducted by our committee to determine: the companies using A.S.A. specifications for poles in the white; the departures made from and the objections to them; and the changes recommended to them. The information obtained by this survey covered principally western red cedar and southern pine poles. Unquestionably the present tentative A.S.A. specifications constitute a decided improvement over the great variety of individual specifications in use prior to their adoption. However, experience in their use indicates that further improvement is desirable and possible without in the least detracting from the value of the work of the committee that prepared the present standards.

In our investigation we found that of the companies purchasing southern pine poles, about half modified the A.S.A. specifications or used their own. In each case the departures from the A.S.A. specifications were more restrictive. In some cases dimensional limitations were placed upon injurious checks; and in others greater restrictions were placed upon scars, shakes, insect damage, pith centers and blue sap stain. Most of the modified specifications imposed greater limitations upon knots. While these more restrictive requirements may be debated, the fact remains that these departures are made and a number of companies purchasing a considerable volume of poles feel that the present A.S.A. standards are inadequate in some respects. In purchasing poles in accordance with specifications for poles in the white one difficulty reported seems to lie in the determination of injurious checks and obtaining poles without checks that may be considered injurious.

It was found that half of the companies purchasing this species of pole on our committee recommended changes in the A.S.A. specifications. It seems certain that some modifications should be given careful consideration. The suggestions include greater restrictions as to pith centers, shakes, splits, insect damage, scars and minimum sapwood thickness. Based upon the recommendations and consideration by our subcommittee, we believe that, as in the case of western red cedar poles, the subject of knot limitations should be studied and based upon some definite limitations upon the reduction in strength. As the use of machine shaving has become more widespread since the formulation of the present A.S.A. specifications, we believe that this subject should be investigated. Several companies report that a number of machine shaved poles are showing excessive checking around knots to such an extent that there is disinclination to use machine shaved poles. It is believed that compression wood within one inch of the surface should be prohibited. If practicable, a dimensional restriction of checks would be of considerable advantage. Our committee is considering these points.

Treating Requirements

Assuming the obtaining of an untreated pole of good quality, with adequate strength and without defects that will shorten its life or reduce the effectiveness of its treatment, before the pole can be considered for installation, there still remains the necessity of saturating such proportion of the volume of wood in the pole as is required to assure a long life pole with the probability of early life failures reduced to a negligible amount. Unfortunately the solution of the problem is not as easy as its pronouncement. Various species of wood, each possessing a different resistance to decay, require different methods and degree of treatment. In different sections of the country, poles exhibit different degrees of resistance to decay. The presence of flying termites in a locality imposes additional requirements for the treatment of poles. The lack of conclusive data is a handicap. In addition to the more or less standardized creosoted poles (butt treated western red cedar and full length treated southern pine), companies represented on our committee are using Z.M.A. treated pine poles, western red cedar poles given the Osmose and the Anaconda paste treatments when erected or Wallaba poles, which are believed to require no treatment.

In the preservative treatment of poles we are concerned not only in obtaining

Table I—Summary of Pole Life Records for Butt Treated (Creosote) Western Red Cedar Poles

Line	No. Poles	Year Set	Inspection After 6 Years						Inspection After 8 Years						Inspection After 9 Years						Inspection After 10 Years						Inspection After 11 Years						Inspection After 12 Years						Inspection After 13 Years					
			% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining			
			D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US
A	239	1924								0.8	99.2																															
B	1074	1923																			0.09	1.2	98.6	0.18				0.8	98.8		0.4			5.4	94.2		0.4		0.4	5.4	94.2			
C	30	1927															100.0																						0.09	11.8	58.5	18.61		
D	200	1923																											99.5	0.5													
E	227	1926															100.0																										
F	542	1924																									1.69	0.38	68.51	26.31	1.13	0.98	1.69	0.39	69.52	26.32	1.13	0.99						
G	316	1924																											93.7	6.3					93.7	6.3							
H	44	1927		4.5	91.0	4.5			6.8	88.7	4.5											0.9	86.5	4.5																			
I	11	1927								100.0													100.0																				
Aver. All Lines				4.5	91.0	4.5			1.7	97.6	0.70						100.0				0.08	1.61	97.9	0.4			0.6	0.30	85.6	12.6	0.5	0.4	0.81	1.33	81.9	14.9	0.62	0.44	0.14	18.8	65.0	16.06		
No. of Poles Used as Base			44						294						277						1129						1297						1097						1313					

*Given a Charring and Spray Treatment in 11th Year. Inspection in 12th Year Showed Poles to Be Sound.

Table II—Summary of Pole Life Records for Creosoted Southern Pine Poles with 8# Empty Cell Treatment

Line	No. Poles	Year Set	Inspection After 3 Years						Inspection After 4 Years						Inspection After 5 Years						Inspection After 6 Years						Inspection After 7 Years						Inspection After 8 Years					
			% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining			
			D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US
A	425	1922																																				
B	242	1930			100.0												100.0																					
C	44	1933			100.0						100.0																											
D	163	1929															100.0												100.0						100.0			
E	109	1927																			4.6	4.6	88.9	1.9									5.5	4.5	89.1	0.9		
F	105	1928									100.0																6.7	93.3											
G	264	1920																																				
H	146	1928																																	97.3	2.7		
I	146	1930															98.7		1.3										98.7		1.3							
J	1160	1925																																				
K	233	1928																									6.0	0.3	78.3	10.7	4.7							
L	70	1929																					100.0												100.0			
M	408	1928																																				
N	40	1934			100.0																														0.2	99.8		
Aver All Lines					100.0						100.0						99.6		0.4		2.7	2.7	93.4	1.2			2.2	1.3	90.4	4.0	2.1		0.7	0.7	98.0	0.6		
No. Poles Used As Base			326						149						531						179						627						876					

Table II (Continued)—Summary of Pole Life Records for Creosoted Southern Pine Poles with 8# Empty Cell Treatment

Line	No. Poles	Year Set	Inspection After 9 Years						Inspection After 10 Years						Inspection After 11 Years						Inspection After 13 Years						Inspection After 14 Years						Inspection After 17 Years					
			% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining			
			D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US
A	425	1922														0.5	99.5					0.5	99.5															
B	242	1930																																				
C	44	1933																																				
D	163	1929																																				
E	109	1927																																				
F	105	1928																																				
G	264	1920																									10.6	11.3	70.2		6.4	1.5	14.1	11.3	70.3		4.3	
H	146	1928																																				
I	146	1930																																				
J	1160	1925							0.4	1.7	97.9				0.4	2.0	97.6																					
K	233	1928	10.6	0.4	75.4	10.6	3.0																															
L	70	1929																																				
M	408	1928																																				
N	40	1934																																				
Aver All Lines			10.6	0.4	75.4	10.6	3.0		0.4	1.7	97.9				0.2	1.6	98.2					0.5	99.5				10.6	11.3	70.2		6.4	1.5	14.1	11.3	70.3		4.3	
No. Poles Used As Base			233						1160						1585						425						264						264					

Key:

D—Poles Removed Due to Decay and Insect Damage.
O—Poles Removed for Other Reasons.
S—Sound Poles Remaining.
M—Poles Remaining with Medium Decay.
H—Poles Remaining With Heavy Decay.
US—Poles Remaining But Unserviceable.

a pole that fulfills our conception of one having adequate treatment when purchased but in obtaining a treatment in which the preservative remains in the wood originally impregnated and retains its toxicity throughout a reasonable service life. Consequently in addition to other necessary characteristics, the preservative and treatment used must have at least the following:

1. The preservative must have such physical characteristics as to permit the wood to be impregnated in the desired quantities and depths.
2. When the wood is once impregnated, the preservative must remain in the wood in sufficient quantities to protect it throughout the desired service life.
3. The preservative must retain its toxicity throughout this period.
4. The original retention must be such as to compensate for the amount of preservative that may be lost by bleeding, dissolving or evaporation and for any possible reduction in toxicity throughout a reasonable service life.

Our industry finds that early life failures are particularly undesirable. The probability of early life failures greatly increases our cost of pole inspections. Early life failures greatly increase the number of outages required for pole renewals, thus lowering the standard of service rendered. For example, consider a transmission line for which poles having an average life of 25 years are used. If renewal of poles due to decay starts at the end of 20 years and all of the poles are replaced at the end of 30 years, the period over which outages are required for renewals will be 10 years. By the renewals being restricted to this 10 year period, usually it will be possible to renew a number of poles during each outage. However, if renewals became necessary at the end of seven years and all the poles were replaced in 30 years, the same average life, namely 25 years, may be obtained; but the renewals would be extended over a period of 23 years. Obviously outages for renewals would be required periodically over almost the entire life of the poles originally installed in the line, to the detriment of the service rendered.

Western Red Cedar Poles

While butt treated (creosote) western red cedar poles have not been studied by the Transmission and Distribution Committee of the Edison Electric Institute for as long a period or in as much detail as southern pine poles, some data have been obtained as the result of the complaint made by several companies that too large a number of poles have been replaced due to decay in too short a time after installation. Our committee feels that such troubles may be due to one or more of the following causes:

1. Initially defective wood due to improper storage conditions or to defects not eliminated in inspection.
2. Defective or insufficient treatment.
3. Lack of toxicity of the creosote.
4. Leaching of the creosote from the treated portions of the wood.
5. Sapwood decay.

A brief summary of the data and opinions submitted on this subject is given as follows: One company reported that while the average data for all poles on the system did not show particularly alarming troubles, an inspection of 543 showed 261 with sapwood decay above ground of which 68 were less than 10 years old and 249 were less than 15 years old. Another company reports a few failures as a result of decay due to improper storage conditions prior to pur-

Table III—Summary of Pole Life Records for Creosoted Southern Pine Poles with 10# to 14# Empty Cell Treatment

Line	Retention	No. Poles	Year Set	Inspection After 4 Years						Inspection After 5 Years						Inspection After 6 Years						Inspection After 7 Years						Inspection After 8 Years						Inspection After 9 Years						Inspection After 11 Years					
				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining			
				D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US
1	10#	521	1926									99.6	0.4																					94.2	5.4	0.4					94.2	5.4	0.4	
2	10#	265	1930								0.8	99.2											0.8	99.2																					
3	10#	286	1931			100.0											2.3	97.7																											
Average All Lines With 10# Poles						100.0					0.3	99.4	0.3				2.3	97.7					0.8	99.2											94.2	5.4	0.4					94.2	5.4	0.4	
No. Poles Used As Base				286						786						286						265											521						521					
I	14#	129	1928																			0.8		99.2										0.7	0.7	88.6	7.0	3.0							
III	14#	289	1928																					72.7		26.9	0.4								2.8	50.8	15.6	26.3	4.5						
IV	12#	323	1930									100.0										0.3		98.1	0.6	1.0																			
V	12.7#	646	1929													0.2		98.3			1.5																							
VI	12#	682	1926																									0.4	0.2	87.7	11.5	0.2											
VII	12#	311	1926																											91.0	8.7	0.3											
VIII	12#	59	1924																																					100.0					
Average All Lines With 12 to 14# Poles												100.0				0.2		98.3			1.5	0.3		88.3	0.3	10.9	0.2	0.3	0.1	88.8	10.6	0.2		0.3	2.2	62.3	12.9	19.2	3.1			100.0			
No. Poles Used As Base										323						646						741						993						418						59					

Table IV — Summary of Pole Life Records for Miscellaneous Treatment of Southern Pine Poles

Line	Treatment	No. Poles	Year Set	Inspection After 4 Years						Inspection After 5 Years						Inspection After 6 Years						Inspection After 7 Years						Inspection After 8 Years						Inspection After 9 Years							
				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining				% Removed		% Remaining					
				D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US	D	O	S	M	H	US		
a.	ZMA	288	1929															100.0						100.0																	
b	ZMA	187	1929															100.0						100.0																	
c.	ZMA	39	1929															100.0																100.0							
Average All Lines With ZMA Treated Poles																		100.0						100.0										100.0							
No. Poles Used As Base																		514						475										39							
(I)	Wolman Salts	51	1927		13.7	15.6	70.0																											17.5		82.5					
(X)	80% Creosote 20% Tar 12#	317	1930		1.6	98.4																				1.6	98.4													
(Y)	71# Creosote 0.5# Mortion Value	17	1926									11.7	88.3																											11.6	88.4		

Key:

D—Poles Removed Due to Decay and Insect Damage.
O—Poles Removed for Other Reasons.
S—Sound Poles Remaining.
M—Poles Remaining With Medium Decay.
H—Poles Remaining With Heavy Decay.
US—Poles Remaining But Unserviceable.

chase. A company, just completing an extensive program of renewing "B" treated transmission line poles, reported that in a seven-month period 33 such poles of from 10 to 15 years old were replaced. As the poles in the program of this company were replaced due to sapwood decay, they were shaved, given a butt treatment of hot creosote and used for distribution poles. One company reports that the "B" treatment is not considered satisfactory but that the incised treatment is believed to be adequate, the only troubles reported with poles given the latter treatment being due to sapwood decay and woodpeckers. Trouble has been reported as a result of interior decay. The other companies reported either insufficient data or that the troubles with this species of pole were negligible.

From the above it may be concluded that while averages indicate excellent performance of butt treated western red cedar poles, some individual cases show alarmingly poor performance. It is believed that the study made indicates that if the producer exercises the best of care in the selection and storage of poles; if the purchaser carefully inspects the poles under rigid specifications; if adequate treatment is given and the results inspected; and if the purchaser stores the poles upon receipt with the proper care, poles of satisfactory life should be obtained.

In table I a summary has been prepared of the pole life records collected in recent years by the Edison Electric Institute for butt treated western red cedar poles. Since the lines were erected and inspected in different years, it is not possible to obtain averages by direct addition. To obtain averages, the results of periodic inspections have been placed in columns based upon the number of years since each line was installed. The percentages in each column were then averaged, weighting each percentage by the number of poles in the line. As more data are obtained on more lines over a longer period of years more conclusive averages will be obtained.

Although no life data are available, three companies report the use of western red cedar poles not butt treated with creosote. One of these does not treat them at all. Another of these formerly purchased butt treated poles but is now experimenting with western red cedar poles with the Osmose treatment. The third company has been purchasing untreated poles and applying the Anaconda arsenic paste treatment, using nine pounds of paste per pole at the time the pole is set.

Southern Pine Poles

Although our committee has approved the AWPA specifications for the creosote treatment of southern pine poles imposing minimum penetration requirements, only four out of 27 companies specify the AWPA minimum penetration requirements. In all cases, the actual penetrations specified are more stringent than the minimum required by the AWPA specifications. These companies claim that creosoted poles are being purchased under these more stringent penetration requirements without difficulty and with the agreement of the treating companies.

The bleeding of creosoted southern pine poles has caused some of our companies no little concern, particularly in using these poles in urban areas. In some instances, the practice of not installing full length creosoted poles in urban and suburban areas has been followed due to fear of bleeding. However, we are glad to note the improvement effected in reducing bleeding in recent years and hope that this improvement continues, providing that it is not at the expense of service life.

Our industry is a large user of southern pine poles. Consequently we are vitally interested in the quality of the timber used and the adequacy of its treatment. As a result of some of the troubles experienced with southern pine poles, we investigated the subject in our committee work. The troubles seemed to be the result of internal decay resulting either from infection of the pole prior to treatment without complete sterilization of the pole during treatment or from checks penetrating beyond the depth of the treated portion of the wood after treatment permitting the pole to become infected. The first cause can be mitigated by exercising stringent precautions and care in the storage and preparation of the pole for treatment. For this reason some companies have very stringent specifications covering the removal of the poles from the woods, their storage and preparation for treatment, particularly when poles are air seasoned before treatment. The second cause of trouble, decay entering through checks, is aggravated by non-uniform penetration or star treatment. Therefore, we are very much interested in penetration requirement as a measure of the results of treatment.

The results of the study of pole life records on test lines of southern pine poles have been summarized in tables II, III and IV. These data illustrate our concern relative to early life failures. For example, one 8 lb. line shows 4.6 per cent of the poles renewed due to decay at the end of six years; another line shows 6 per cent renewals in seven years; another 5.5 per cent after eight years; and still another 10.6 per cent in nine years. From the point of view of poles removed due to decay overall results indicate that better results are obtained for 10 lb. and 12 lb. retentions. Since in recent years there has been a decided improvement in the treatment of southern pine poles, it is hoped that lines recently installed will show much improved life records. The problem that has concerned us is the determination of a penetration requirement that will eliminate or greatly reduce early life renewals due to decay. We look to the treating industry to continue to improve the practices followed in preparing the trees for use as poles and the technique of pole treatment.

The R. B. Marshall Award

THE terms and conditions governing a new cash award recently established by Mr. R. B. Marshall, president, Electromaster, Inc., to promote greater activity and efficiency among utility retail salesmen in electric range placements have been announced.

The award consists of $500 divided into five prizes of $100 each, offered through the Edison Electric Institute for utility representatives who sell, lease or rent during the calendar year 1938 the greatest number of individual domestic electric ranges of a rated capacity of five kilowatts or more.

Utilities will be divided into five classifications as follows:

1. Serving up to and including 25,000 domestic customers.
2. From 25,001 to 50,000.
3. From 50,001 to 100,000.
4. From 100,001 to 250,000.
5. Serving over 250,000.

Terms and Conditions

1. To be eligible to submit a sales record for a national prize, the sales person must have been employed by the utility company for at least six months of the calendar year 1938 and must be in the employ of the utility at the close of the contest period December 31, 1938.

(*Continued on page 72*)

Eighteen Utility Employees Awarded Edison Electric Institute Medal for Resuscitation in 1937

EIGHTEEN Edison Electric Institute Medals for Resuscitation by the Prone Pressure Method were awarded to employees of member companies of the Institute in 1937. Three of the Medals were awarded in the states of Pennsylvania and Virginia; two each in Maryland, New Jersey and Texas; and one each in Maine, North Carolina, New York, South Carolina, Utah and Virginia.

Other Medals are pending presentation, while data on other cases are being considered by the Judges, Mr. E. W. Gorry, Consolidated Edison Company, Chairman.

The Edison Electric Institute Medal was established by the Board of Trustees of the Institute in 1933 as an award to employees of member companies who have successfully resuscitated, by the Schafer Prone Pressure Method, individuals suffering from electric shock. The award is intended to serve both as recognition of the performance of the act and to encourage and maintain interest in the training of employees in the use of the Schafer Prone Pressure Method of Resuscitation.

A certificate describing the service rendered and signed by the president of the Institute is awarded with each Medal. In some cases where a Medal has been awarded, a certificate of assistance has also been awarded to those who have rendered valuable aid in the resuscitation. Recently, provision has been made to award small replicas of the Medal to those who have assisted.

The names of the recipients of the Medals and brief statements of the circumstances leading to the awards follow:

E. J. GRAVES
Maine

On May 14, 1935, a line crew of the Bangor Hydro-Electric Company of Bangor, Maine, was engaged in aligning poles at Corinth, Maine. In the course of this work, it was necessary to alter the overhead wires so as to allow the poles to assume a perpendicular position.

Wyatt Spencer, a lineman, was working aloft when his head came in contact with a 13 kv wire while his hands held a low tension wire upon which he was working. His body cleared from contact, and slid slowly down the pole to the ground, his safety belt served to retard the descent. Two of his associates, Percy Burton, Foreman, and E. J. Graves, Lineman, who were on the ground, unbuckled Spencer's safety belt, and Graves immediately applied the Schafer Method of Resuscitation until the injured breathed without assistance. He was taken to a local doctor's office in a vehicle offered by an unknown person, and then removed to a hospital for further treatment.

The Edison Electric Institute Medal was presented by Mr. Walter Brennan, State Safety Director to Mr. Graves, and a Certificate of Assistance to Mr. Percy Burton, at the closing session of the Maine Safety Conference, held in Portland, Maine, on Sept. 24, 1937. Local newspapers published full details of the presentation ceremonies.

CHARLES A. CHAMBERLAIN and SHARP C. GILLESPIE
Utah

A section of overhead wires of the Utah Power and Light Company was damaged in a snow slide at Provo Canyon, Utah, on Feb. 21, 1936. A crew of linemen was dispatched to the scene to make temporary repairs for the restoration of service to consumers in the vicinity. For protection during repairs, the repair crew proceeded to isolate the faulty section by the manipulation of jumpers at points somewhat distant. It was later discovered that one of the line transformers was connected so as to render the sectionalizing void, as one conductor remained alive in the apparently isolated section at a potential of approximately 6600 volts to ground.

Not being aware of the danger, the crew proceeded to erect the necessary poles, and to place the fallen wires thereon. Fred J. Richan, a groundman, attempted to pull one of the conductors from under the snow, and received a shock which rendered him unconscious and caused him to roll down the snow embankment for a short distance. Charles A. Chamberlain immediately started resuscitation, but made way a short time later for Sharp C. Gillespie who was somewhat more experienced in the application of the Schafer Method. However, in five or ten minutes the injured breathed without assistance, and was removed to the company's plant at Nunn's to await the arrival of a physician. Upon receiving medical treatment, he was taken to his home for convalescence. The line members who so ably assisted in supplementary aid are Millard A. Beck, Edward W. Booth, Byron Clark, George Crookston, Eugene Hawkins and Earl P. Hogan.

At a spring Employee Meeting of the Utah

E. J. Graves

Chas. A. Chamberlain

Sharp C. Gillespie

George W. Akers

R. George Hayes

Paul Stoner

James Stone

H. A. Tankersley

Power and Light Company held at Provo, Utah, on March 10, 1937, Edison Medals, and Certificates of Assistance, were presented by Dr. Adam S. Bennion to Messrs. Chamberlain and Gillespie and those who participated in the resuscitation. Publicity was given to this presentation in the local paper.

GEORGE W. AKERS
West Virginia

While engaged in alterations to overhead wires at Logan, W. Va., William A. Berry, a lineman in the employ of the Appalachian Electric Power Company, came in contact with a wire carrying 2300 volts. The accident was due to one of his climbers, which was not securely driven into the pole, cutting out and causing his body to wheel about. This movement dislodged the protective rubber line hose, and allowed his body to come into contact with a live wire which caused him to lose consciousness.

He was lowered to the ground by George W. Akers, another lineman, who immediately started resuscitation. Akers continued artificial respiration for about fifteen minutes until Berry showed signs of life, and was then relieved by Hurston Drenner who continued for about three minutes more until the injured breathed without assistance. The injured was removed to a local hospital for further treatment.

The presentation of the Medal to Mr. Akers and the Certificate of Assistance to Mr. Drenner took place at a Company picnic near Clothier, W. Va., on Sept. 4, 1937, at which approximately three hundred and fifty people were in attendance. Mr. H. D. Stillman, District Manager of the Company made the presentations.

R. GEORGE HAYES
Pennsylvania

On Sept. 22, 1936, Eugene G. Saylor, an electrical contractor, was engaged in repairs to an overhead power line serving a consumer of the Penn Central Light & Power Company at Huntingdon, Pa. A service engineer of the Power Company was at the location with Saylor, when the contractor received an electric shock which rendered him unconscious.

The service engineer, R. George Hayes, was assisted by a resident of the locality in lowering Saylor's body to the ground, and Hayes immediately started resuscitation, meanwhile requesting some children to summon medical aid. The injured was restored to consciousness in about ten minutes, and an ambulance which had been called, arrived to give first-aid treatment. He was taken to the hospital for further treatment.

Mr. J. Harry Shearer, President of the Company, presented the Medal to Mr. Hayes at their annual party on April 10, 1937. There were more than one thousand men and women in attendance. Publicity was given to this occasion by the various newspapers.

PAUL STONER
Virginia

Robert Lee Funkhouser, a schoolboy, age 11 years and 9 months, climbed an electric light pole on his way home from the Hamburg Grade School at Mt. Jackson, Va., on Sept. 21, 1936. Obviously unaware of the danger in connection with this playful act, he swung his body out on a 2300 volt single phase line. The resulting electric shock caused him to lose consciousness, and he fell to the ground.

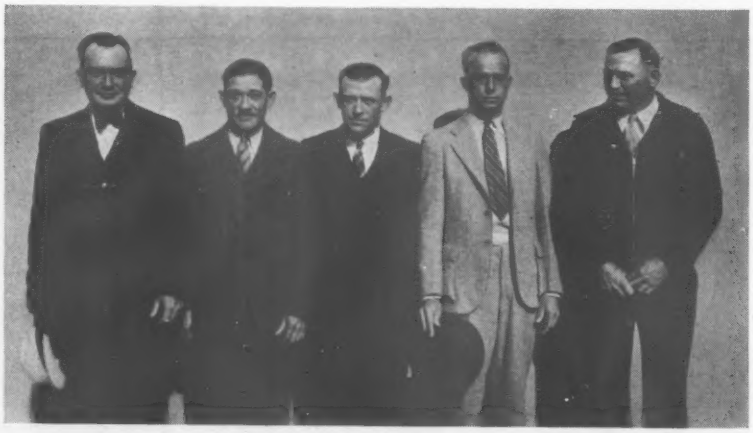
Paul Stoner, a lineman for the Virginia Public Service Company arrived on the scene about five minutes later, and immediately started resuscitation. In about fifteen minutes the injured breathed without assistance, and he was taken to a local physician's office in Stoner's car. He was later taken to the hospital in an ambulance, but subsequently died of his injuries.

The Award of the Medal was made by Mr. Lewis Payne, former Vice-President and General Manager of the Company at the George Mason Hotel, Alexandria, Va., on Friday, March 5, 1937. Approximately one hundred and fifty representatives of the Company attended. It is estimated that forty-five Virginia newspapers carried the story.

STUART T. SIMPSON
Virginia

A construction crew of the Virginia Electric and Power Company was engaged in the installation of additional equipment in the Atlantic substation at Virginia Beach, on June 19, 1936. The work was being done within an enclosure containing lightning arresters, one group of which were dead for the protection of the workmen.

Addison F. Black, a substation operator and inspector who was assisting in this work, attempted to jump over the fence at the opposite end of the enclosure, and touched one of the live lightning arresters, receiving an electric shock which rendered him unconscious. Stuart T. Simpson, another member of the crew, immediately applied artificial respiration, and continued for about fifteen minutes, when the injured breathed without



Left to right—L. P. Wallace, A. J. Verdine, C. G. Wallace, P. S. Cornette and A. C. Lueckert.

Left to right—Stuart T. Simpson, C. H. Wright, C. B. Sandler and F. A. Black.

Left to right—W. P. Beyerle, K. M. Jones, Albert M. O'Shea and C. M. Cohn, Vice-President, Consolidated Gas, Electric Light and Power Company of Baltimore, presenting Medal.

assistance. Valuable assistance was rendered by C. B. Sandler and C. H. Wright. The injured was treated at the scene by a local physician, and then removed to the hospital.

A celebration in the way of a "Safety Social" for employees and their families was held on Friday, May 14, 1937, in the auditorium of the Company and was attended by three hundred employees and guests from Norfolk, Portsmouth, Suffolk and Richmond. Mr. R. J. Throckmorton, Vice-President, presented the Medal to Mr. Simpson, and Certificates of Assistance to Messrs. Wright and Sandler.

JAMES STONE
North Carolina

On Sept. 25, 1936, work was in progress on the installation of a cross-arm on an "H" frame structure at the Hartsville, N. C., substation of the Carolina Power and Light Company. It was necessary to fasten this timber between two upright poles, and in the course of the work W. W. Southern, a lineman, came in contact with a 22 kv disconnecting switch which was located above his head.

He immediately lost consciousness, and his body slid down the pole to the ground. James Stone, a lineman who was working at the adjacent pole, climbed down, and immediately applied artificial respiration. Other linemen rendered supplementary aid, and called a local physician who arrived shortly after the accident and rendered medical aid. The injured breathed without assistance at this time, and was removed to the hospital for further treatment of his injuries.

The Edison Medal was presented to Mr. Stone on May 8, 1937, at a dinner attended by a large number of his fellow workers. The presentation was made by Mr. J. A. Jones, Superintendent of Transmission and Distribution, in the presence of Mr. Southern. The local newspapers carried publicity regarding the resuscitation and presentation of the Medal.

Jos. DeWolff

WALLACE LINE GANG
Virginia

On Nov. 24, 1936, a line crew of the Virginia Electric and Power Company were working near a wooded section approximately seven miles from the city along a single track interurban car line, five hundred yards from the highway. Carroll G. Wallace while removing insulator tie wires from a three phase 2.3 kv circuit made contact with his left hand while changing position on the pole and in trying to clear himself his right hand caught the outside phase. A. J. Verdine, lineman, working on the same pole, kicked Wallace's climbers from the pole. Wallace dropped approximately four feet, his safety catching on Verdine's climbers. The truck being six hundred feet from the pole and no hand line available, the foreman, L. P. Wallace, instructed Verdine to let Wallace drop to the ground where he was caught by fellow workers.

Artificial respiration was immediately started by the foreman and it was approximately fifteen minutes before Wallace breathed without assistance. First aid was rendered by other members of the crew, after which he was removed to the hospital. The injured suffered third degree burns on the first, second and third fingers, palms of both hands and shock. The second fingers of both hands were amputated the following day.

The Edison Medal was presented to the Wallace Line Gang by Mr. R. J. Throckmorton, Vice-President of the Company, at a meeting on May 14. Miniature Medals were presented to Messrs. L. P. Wallace, Foreman, A. J. Verdine, P. S. Cornette and A. C. Lueckert. An account of the resuscitation and award was carried in the local newspapers.

H. A. TANKERSLEY
Texas

On Nov. 27, 1936, a crew of the maintenance mechanics were engaged in the inspection of oil circuit breakers at the Kerrville Substation of the Texas Power and Light Company. This work was under the supervision of the foreman, Guy McKee. In the course of the inspection, Mr. McKee examined the metal covering of an oil circuit breaker which was alive, and in some manner came in contact with one of its conductors. He received an electrical shock which rendered him unconscious.

H. A. Tankersley, maintenance man, immediately started artificial respiration, and continued for about two minutes with successful results. The injured man was taken to a nearby doctor's office for first-aid treatment, and then to the hospital.

Mr. Tankersley was presented with the Edison Medal by Mr. C. J. Rutland, Safety Director of the Company, on July 23, 1937, at a gathering of members of the Taylor, Tex., district, and their families. The newspapers of Taylor and nearby towns carried articles pertaining to the award.

JOSEPH DeWOLFF
New York

On Nov. 8, 1936, J. DeWolff, electrical mechanic, and Ernest Haglund, generator wiper, were assigned to clean electrical equipment on No. 8 boiler precipitators at the East River Station of the Consolidated Edison Company of New York, Inc. Haglund placed a ladder against the East wall of compartment No. 81 and climbed up to clean the insulators overhead, while DeWolff, with his back toward the compartments, was taking readings. DeWolff heard a scream and discovered that Haglund, in some unknown manner, had fallen into compartment No. 91, which was alive.

The current limiting resistor was broken by his fall, opening one leg of the high voltage side of the circuit at that point. Landing on his feet, Haglund fell backwards over the motor with his head against the polarity

Left to right—A. N. Cartwright, Vice-President, West Penn Power Company, presenting awards to Lloyd W. Slagle, Charles R. Hutson, James L. Chase, Claude W. Shafer, Thomas H. Munce and Lewis W. Chew.

indicator, his right hand holding live lead and his left hand holding wire mesh of the locked door. DeWolff quickly pulled the main 440 volt feed switch, grounded the circuit, notified the telephone operator, and climbed into enclosure No. 91. He placed Haglund in a prone position and administered artificial respiration for about three minutes when Haglund regained consciousness. He was removed to the hospital for further treatment.

At the Annual Meeting of the Association of Employees of The New York Edison Company, Inc., on May 11, 1937, Colonel John Stilwell, Vice-President of the Consolidated Edison Company of New York, Inc., presented the Edison Medal to Mr. DeWolff. The meeting was attended by more than one thousand people — members, guests and friends of the recipient.

CANONSBURG LINE CREW

Pennsylvania

Charles Conrad, a member of a line crew of the West Penn Power Company, having completed his work of connecting the transformer and arc circuit on a pole at Bethel Township, Pa., attempted to pass the hand line to Charles R. Hutson. His foot slipped on the crossarm and he fell over the transformer arm to the hot side, his arm coming in contact with the lower riser from the Pierce pin, and his abdomen making contact with the lower crossarm brace, while his thighs contacted the transformer loop to the cutout. Hutson shoved Conrad clear and the injured slid around the pole and again came in contact with the riser, brace and loop in the same manner as described. He was again immediately cleared and lowered to the ground, where Hutson started artificial respiration. He continued for twelve minutes before the patient breathed without assistance. Conrad was then removed to the hospital. The injured received first, second and third degree burns on the left arm, abdomen and left and right legs.

On April 23 at the Keystone Hotel, Pittsburgh, Mr. A. N. Cartwright, Vice-President of the West Penn Power Company presented the Edison Medal and Certificate to the Canonsburg Line Crew, as well as miniature Medals to Messrs Charles R. Hutson, James L. Chase, Lloyd W. Slagle, Claude W. Shafer, Thomas H. Munce and Lewis W. Chew.

ALBERT M. O'SHEA

Maryland

On April 20, 1937, Albert M. O'Shea was working in his regular capacity as a senior lineman for the Consolidated Gas Electric Light and Power Company of Baltimore. The crew was working on General's Highway, East of Crownsville, Md. Lineman William R. Ayers had been sent up a pole to tie in three wires on the bottom crossarm. O'Shea and the other men of the crew remained at the truck which was parked opposite the pole. After Ayers completed tying in the wires, he unhooked his safety belt and started to change his position so as to climb down the pole. In doing so, his left shoulder came in contact with the 13,000-volt line on the second crossarm of the pole. He received a shock and fell approximately 34 feet to the ground.

All members of the crew rushed to the base of the pole and O'Shea immediately began application of the prone pressure method of artificial respiration. After about five minutes Ayers showed signs of life. When Dr. G. H. Faubert arrived about ten minutes after the accident occurred, Ayers was conscious and breathing voluntarily. He was removed to the hospital for treatment of his injuries.

On Aug. 18, 1937, Mr. Charles M. Cohn, Vice-President of the Company, presented the Edison Medal to Mr. O'Shea.

F. I. WHALEY

Texas

On April 21, 1937, Alonzo Richardson employed as Lineman by the Texas Power and Light Company, was changing out cross arms on a pole at the corner of Brockett and North Travis Streets, Sherman, Tex. F. I. Whaley, also employed as Lineman, was working on top of the cross arm and Richardson was underneath the buck arm on the pole. Richardson was standing and facing East when he was about to put the hoods on conductors. He touched the toe of his right foot against the top of the conduit and at the same time his arm touched the primary tap above his rubber glove. Whaley's attention was called to the accident by an apprentice lineman who was on the ground.

After three attempts Whaley succeeded in freeing Richardson from contact and he fell back limp in his safety belt. Richardson was not breathing and it was necessary for Whaley to hold him up to keep him from falling out of his safety belt. This he did with his left arm and he applied prone pressure with his right arm and hand. Richardson started to breathe after about four or five minutes. He was then lowered to the ground where the foreman of the crew, R. S. McAfee, continued the application of the prone pressure method.

Mr. B. H. Peacock, Field Safety Engineer of the Company, awarded the Edison Medal to Mr. Whaley on Oct. 13, 1937 at a meeting of approximately sixty employees of the Company, together with their families, at Sherman, Tex. Certificates of Assistance

Left to right—Henry Allen, F. I. Whaley, A. Richardson, O. R. Gresham, Roy Thompson, R. S. McAfee.

Leonard James

Award of Medal to Robert E. Liller by Vice-President George S. Humphrey at Keyser, W. Va. Left to right—H. H. Forman, O. C. Henry, H. T. Liller, G. L. Johnston, J. R. Shryock, Geo. S. Humphrey, Robert E. Liller, G. R. Shoemaker and Elmer C. Miller.

were also presented to Messrs R. S. McAfee, O. R. Gresham, Henry Allen, Roy Thompson and Ben Harp.

HENRY B. FULLER
New Jersey

While pulling in new No. 1-0 wire on the Wiliamstown-Pitman transmission line to replace No. 4 wire on tap, 33 kv circuit, the No. 1-0 wire swung into phase of 4000-volt line and into old No. 4 wire simultaneously. William R. Jess, who was holding No. 4 wire, was knocked to the ground. The wire was knocked from his hand and resuscitation was started immediately by Henry B. Fuller, a fellow employee. After about eight minutes Jess was able to breathe without assistance.

Jess had been standing knee high in wet grass and the balance of his clothing was wet with perspiration. At the time he was wearing rubber gloves which afterward tested 20,000 volts for five minutes. It is believed that shock was due to "creepage" over wet glove and wet shirt sleeve. An unusual feature of this accident is that 24 small electrical burns covering the area from Jess' right thigh to his ankle did not appear until approximately ten hours after the accident.

Since the filing of the application for the Edison Electric Institute Medal in behalf of Mr. Fuller and the approval of the application, and the engraving of the Medal and Certificate, Mr. Fuller died. His Medal and Certificate were awarded posthumously and sent to his wife, Mrs. Henry B. Fuller, on Nov. 10, 1937 by Mr. A. E. Lewis, Vice-President and General Manager of the Atlantic City Electric Company, Atlantic City, N. J.

LEONARD JAMES
New Jersey

A line crew of the Atlantic City Electric Company was working at Beach Haven Parks, N. J., on the morning of July 9, 1937. A short block away the gas construction crew of the Jersey Central Power & Light Company was working and one of the crew noticed a lineman had slumped in his safety belt. He called this to the attention of another lineman who ascended the pole on which Curt J. Muller, the injured man, was hanging in his safety belt with his legs over the crossarm and his head down. When Muller was lowered from the pole he was unconscious and not breathing.

The foreman of the gas construction crew, Leonard James, immediately applied the prone pressure method and Muller regained consciousness in about five minutes. At the time of the accident Muller had been placing rubber hose on the primary wire and was not wearing rubber gloves. He suffered a burn on the palm of his right hand.

At a testimonial dinner held for Mr. James on Jan. 11, 1938, the Edison Medal was presented to him by Mr. Halsey D. Pohlemus, Vice-President of the Jersey Central Power and Light Company. The newspapers of Toms River, and surrounding cities, carried a story of the award.

LINES DIVISION
Keyser, West Virginia, District

On the morning of July 12, 1937 at 11 a. m., Robert E. Liller, a lineman employed by the Potomac Edison Company, was working on a corner pole one mile East of Dawson, Md., replacing wood corner pins with steel pins on double arm. He had changed one pin on one end of the arm and swung

(*Continued on page 66*)

Line Crew of Edison Light and Power Company. Left to right—Clark Updegraff, F. W. Hinea, Jerome Noel, Samuel Harmon, Harry Kurtz and Jerry Swan.

D. D. Rhame

Materials and Supplies Accounting System of the Detroit Edison Company

By A. J. Provencher
Detroit Edison Company

A paper presented at the National Accounting Conference, E.E.I., Detroit, Mich., Nov. 8-10, 1937

THE Detroit Edison Company maintains thirty-two warehouses serving an area of 7587 square miles. Stocks in warehouses are replenished either by transfer from primary warehouses or by purchasing for direct delivery from vendors, whenever quantities involved and transportation costs justify it.

Each storekeeper has a hand-posted record of the materials assigned to his care.

Multiple instead of single item requisitions are used from which is punched a tabulating card for each item. Various reports are obtained by passing these cards through tabulating machines, some in tape form—others in ledger sheet form. One tape serves as a credit to our Materials and Supplies Account on the general ledger while another carries the necessary detail for posting to our work order and account ledgers. Absolute accuracy is here obtained as the same cards, once punched and proven, are used for both reports.

The value of items disbursed is not shown on the requisitions or punched in the cards. We employ a method of group pricing and extending, instead of pricing and extending each item on a requisition. Our prices are accurate average prices arrived at by summarizing and posting all receipts and other miscellaneous entries, affecting the price, to the price record card, once each month. The prices are then re-averaged.

A summary is prepared once a month which shows the quantity of each item charged to each work order and job number, and the total quantity of each item passed out of stock during the month to all work orders. This summary is in the form of a tabulated tape arranged by stock number and work order charged. In other words, like items are brought together on the tape and require only one pricing during a month. Like items are also extended only as many times as they are charged to different work orders.

MR. PROVENCHER

Extensions are made directly onto the tapes which are fed through Burroughs bookkeeping machines. All extensions for a stock number are totaled in the machine and this total is printed on the tape. These totals are later posted to the Accounting Department's record of materials and supplies which is the same record referred to earlier as the price record card.

About three hundred main and subclass summary cards, carried in this record, control the detail cards preceding them. These cards are the detail of our Materials and Supplies Account in the general ledger.

Tabulating machines summarize individual transactions, grouping them for economical posting to the work order and account ledgers. The advantage of a detailed posted record is not sacrificed as reference lists are prepared on fast listing machines from the punched cards. These lists are placed in file for reference purposes and afford the detail formerly typed in the ledgers of account.

The tabulating cards representing debits and credits to certain property accounts are accumulated for the year and one tabulation is then made for posting to our property records.

Old System

1. Large inventory differences and difficulty in reconciling inventory with the Materials and Supplies Account were two factors which caused this Company to discard their old plan and install a new system of Materials and Supplies accounting.

2. Under the former system physical inventories were taken periodically throughout the year and adjustments for differences were made to the records at the warehouse, central office and the Materials and Supplies Account in the general ledger. The year-end inventory was compiled from the balances on the central office records and was priced at the current unit price. Approximately twelve thousand different items had to be priced, extended, and tabulated to stock class before a comparison could be made with the Materials and Supplies Account. In addition to this work and before the differences could be determined, the Materials and Supplies Account had to be reconciled so that it did not contain items which were received and included in the inventory but not paid for, and vice versa, items which were paid for and not received.

3. Our old method of unit pricing was, to a large extent, the cause of differences in inventory values, because unit prices were carried on a separate record and errors in pricing or extending did not affect the unit price card. Such errors did affect the Materials and Supplies Account which was charged or credited with the value of each transaction. We found discrepancies were unavoidable in a system where the quantities were recorded entirely separate from these respective money values. To correct conditions existing at that time, it was deemed essential to have a combined central office record which would

reflect the total value of each item of stock as well as the quantity on hand throughout the system and thereby permit an accurate average price of the stock left on hand.

Present System

4. Our present system was installed in January, 1926. It has fulfilled all our requirements: first, adequate control of stock in both quantity and money, i.e., just enough and not too much stock on hand at all times; second, a record which would balance with the Materials and Supplies Account in the general ledger at any time, and which would reflect also, as nearly as possible, the actual amount of stock in the warehouse; third, a record which would permit a true average price.

5. Most of our Materials and Supplies are classified according to kind of material rather than according to use. Each item is assigned a stock number consisting of seven digits. The first two digits signify the main group or main class in which the item falls; the third digit, the sub-group or sub-class, and the last four digits identify the item itself as follows:

ILLUSTRATION OF CLASSIFICATION
STOCK NUMBER 10-0-0001

10—(Main Group) Masonry (including all concrete material)

10-0—(Sub-Group) Cinders, Gravel, Sand, etc.

10-0-0001—(Item) Cement

There are at present 62 main groups or main classes, 307 sub-groups or sub-classes and some fifteen thousand items.

6. Our Stores Department deals only in quantities; money values are controlled by the Accounting Department. All documents affecting quantity, other than adjustments, originate in the routine at the warehouse where they are renumbered consecutively. This number, assigned by the warehouse, hereafter referred to as the reference number, indicates that the material has been received or delivered by the warehouse and has been posted to their records.

The Accounting Department record carries both quantities and values, but is not subdivided by warehouse locations. A scheme has been devised, however, which permits discrepancies to be quickly traced to any warehouse. The Accounting Department record will hereafter be referred to as the Materials and Supplies Control Cards.

How Materials and Supplies Control Cards are Balanced with the Materials and Supplies Account

The following accounts are used and are taken into consideration when balancing the Materials and Supplies Account with the individual commodity cards. They also permit the warehouse to be charged only with those materials which have actually been received by it.

Materials and Supplies Account
Materials and Supplies in Transit Account
Liability for Invoices Not Received Account
Material Sales Clearance Account

The definitions of the foregoing accounts follow:

Materials and Supplies Account

This account is charged with all material received by the warehouses and credited with all disbursements from stock as explained hereinafter. The balances at the end of the accounting period represents the balances on the Control Cards as of the 15th of the month, the closing date at all the warehouses. The work is usually received and tabulated by the 19th of the month, which enables the Accounting Department to furnish financial statements promptly in a manner to be explained later.

Materials and Supplies in Transit Account

All Materials and Supplies invoices and freight bills are charged to Materials and Supplies in Transit. A tabulating card showing the date, purchase order number, amount, and register number of the invoice, is punched for each invoice and filed by register number in the "In Transit" file. Each invoice is given a different register number for the purpose of identification.

The credit to this account is obtained through the reports of Stock Material Received (Exhibit No. 4 of illustration). The price, register number and amount from the invoices are entered on this report by the Audit Division where the quantity billed on the invoice is checked against the quantity received by the warehouse. Tabulating cards are punched from the report of Stock Material Received from which a tape is tabulated in register number order showing the purchase order number, register number, and amount. Notification is thereby served to pull the card from the "In Transit" file. The above tape is the basis for a monthly journal entry which charges Materials and Supplies and credits Materials and Supplies in Transit for materials received and paid for.

Liability for Invoices not Received Account

Material received during the month, but not paid for (invoice not received) at the time of closing, is charged by journal entry to the Materials and Supplies Account and credited to Liability for Invoices not Received Account in the general ledger. The Materials and Supplies Account would not balance with the Control Cards unless the above receipts were recorded, inasmuch as the Control Cards show all materials actually received.

Invoices charged to Materials and Supplies in Transit close on the last day of the month. Many invoices received after the 15th of the month pertain to materials received prior to the 15th of the month. These are handled by a journal entry which debits Liability for Invoices not Received and credits Materials and Supplies in Transit. All journal entries pertaining to invoices received between the 16th and end of the month are reversed the following month.

Material Sales Clearance Account

This account is charged with sales of material and with material taken from stock and returned to vendors and is credited when the vendee or vendor is billed. It is used primarily to provide for the difference in closing dates. Materials sold or returned after the 15th of the month are billed and the invoices distributed. The distribution cannot be made to Materials and Supplies as that account is already closed for the month. Therefore, these items are cleared through the above account.

Explanation of Forms and Their Uses
(See Exhibits on next page)

Exhibit No. 1—*"Warehouse Request to Purchase Stock Material"*

To replenish warehouse stocks by purchase, the warehouse prepares a Warehouse Request to Purchase Stock Material (Exhibit No. 1), showing the balance on hand and usage. This information is necessary in approving the request for purchases. This form is sent to the Stock Control Division of the Stores Department where it is checked. A "Permanent Requisition to Purchase Material" form (Exhibit No. 2) which provides spaces for twelve individual purchases of an item is then withdrawn from the file, filled in with date, quantity and date delivery is required, approved by the General Storekeeper or one of his assistants, and sent to the Purchasing Department.

Exhibit No. 3—*Purchase Order*

The necessary information for the issuance of the Purchase Order is obtained from Ex-

Exhibits 1-22, inclusive

hibit No. 2. Quoted prices are received from vendors before the order is placed. A copy of the Purchase Order is sent to the Audit Division which checks the price billed by the vendor against the price on the Purchase Order—vendor's quoted price.

The warehouse requesting the material receives three copies of the Purchase Order. These copies inform them that their requisition is being filled, state when the material is to be expected and from whom.

Exhibit No. 4—*"Report of Stock Material Received"*

When all material is received in one shipment the No. 9 copy of the Purchase Order (Exhibit No. 4) is checked, signed by Storekeeper, posted to the warehouse record and forwarded to the Stores Department office. When only a portion of the material is received, a "Report of Material Received," not shown, is made out at the warehouse. From there, these are sent to the Audit Division where they are filed under vendor's name until an invoice is received. After the invoice has been received and posted, the No. 9 copy or the Report of Material Received is forwarded to the Tabulating Bureau where tabulating cards are punched.

If the invoice is not received before the closing date, the No. 9 copy or the Report of Material Received is priced from the Purchase Order and forwarded to the Tabulating Bureau. After tabulation it is returned to file to await the invoice.

When the invoice is later received, the amount is noted on the Report of Material Received which is again sent to the Tabulating Bureau. If the invoice differs from the original purchase price, another card is punched to adjust the original amount to the actual amount of the invoice.

Exhibit No. 12—*"Stock Received Record" Tabulating Card*

The Report of Material Received, Exhibit No. 4, furnishes the information punched in the "Stock Received Record" card, Exhibit

No. 12. The Purchase Order, warehouse location, report of stock material received number, quantity, stock number, and amount are punched in the card.

Exhibit No. 12 is punched in duplicate. The original is filed in the Material Received file and is used in preparing the warehouse reference tapes and control card posting tapes. The duplicate card is filed under "Material Received and Not Paid For" whether or not it is paid for. When the original Stock Material Received report is received, indicating that the invoice has been paid, the invoice register number is punched in the duplicate card and the card is held in a special file until the closing date. A "Material Received and Paid For" tape is tabulated from these cards. The remaining cards in file without register numbers are used to prepare a "Material Received and Not Paid For" tape.

Exhibit No. 15—*Report of "Stores Material Received"*

This report is tabulated from cards, Exhibit No. 12, and represents all stock materials received from vendors during the month.

Tabulating cards are punched and verified daily and held until the closing date. They are then sorted numerically to stock number and tabulated. The tabulating machines control on each stock number, i.e., the quantity and amounts on any group of cards having the same stock number are consolidated and only two totals printed, one for the total quantity, and one for the total amount. Besides performing the above consolidation, the machines add these amounts in other registers and print the totals at the end of each stock sub-class. This is the first tape to be tabulated and is used as a medium for posting to the Control Cards and is the first item posted on the control Cards at the end of the accounting period.

Exhibit No. 7—*"Requisition for Material from Stock"*

This form, when properly approved, is the authority for the release of material from the warehouse. The stock numbers are checked by the clerk in the warehouse. After the requisition is posted to their records, it is forwarded to the Accounting Department for work order approval and tabulation.

Exhibit No. 13—*"Materials and Supplies—Detail Card"*

This card, which is punched from Exhibit No. 7, carries the work order, location furnishing material, reference number, quantity and stock number.

Money value is not punched at this time because the various forms from which these cards are punched are not priced or extended. Detailed explanation of how we price and extend is given in a following paragraph.

Exhibit No. 16—*Report of "Stores Material Disbursed"*

This report includes all unpriced items for the month, both debits and credits, a small amount of materials returned to stock on which the original price cannot be determined, and all other minor adjustments. The following detail is tabulated from Exhibit No. 13: work order, stock number, total quantity charged to each work order, total quantity of each stock number. The stock numbers follow in numerical sequence which facilitates pricing, extending and posting.

The unit price (carried out three decimal places) is written at the beginning of each stock number. The priced tape is placed in the machine used to multiply the unit price by the quantities.

Burroughs bookkeeping machines are used to extend the unit price times the quantity. The unit price for each stock number is set up once in the machine as the multiplicand. The keys of the machine are depressed the same as on a typewriter. The product is automatically printed on the tape opposite the quantity when the product key is operated. The machine then spaces to the next item.

The products are automatically accumulated in another register and the sum of the products printed beside the total quantity of each stock number. This sum, as well as all subsequent sums for the other stock numbers on the tape, is cleared out of the first register and transferred into a second register as the extension for each stock number is completed.

The individual products are verified by multiplying the total quantity of each stock number by the unit price. The resultant amount is shown under the sum of the products (see Exhibit No. 16) and obliterated later when the two amounts are found to be in agreement.

A grand total of the tape, which is used for checking purposes, is obtained by clearing the second register.

"Material Returned to Stock" and "Material Sales Requisitions"

Materials are carried in stock at cost price until disbursed or scrapped. The original price of material returned to stock is obtained by the Accounting Department from the work order to which it was charged and is returned to stock at the original cost. Small miscellaneous items and unidentified materials are taken into stock at the current average price.

Cards punched for materials returned to stock during the month are segregated and a special tape tabulated showing the stock sub-classes and amounts. In this way the value of Material Returned to Stock is easily determined.

Materials returned to vendors and sales of material are recorded on a Material Sales Requisition by the warehouses and charged to Material Sales Clearance Account. The current unit price as shown on the detail control cards is used to cost price the material sold.

Report of Miscellaneous Priced Items

This report consists of all priced stock items, such as materials returned to stock, sales of materials and materials returned to vendors. It is the second tape to be posted to the control cards at the end of the accounting period.

Exhibit No. 20—*"Materials and Supplies Record" or Detail Control Card*

Reports of material received, miscellaneous priced items and material disbursed are posted monthly by Burroughs bookkeeping machines to the detail control cards in the above named order. All postings are made from tabulated tapes. Receipts are posted in red, disbursements in black.

The cards are offset in the file by the posting machine operators as they post the first two tapes (receipts and miscellaneous priced items). These two tapes contain all the potential unit price changes, therefore new unit prices are calculated by dividing the total quantity balances, after posting, into the total money balances, on all the offset cards.

No separate price index is maintained, the average unit price being noted on the detail control card. The re-averaged price is used to price reports of "Material Disbursed," Exhibit No. 16.

Exhibit No. 19—*"Materials and Supplies Sub-Class Control Record"*

The detail control cards, Exhibit No. 20, which are in reality the detail of the Materials and Supplies Account, are filed numerically by stock numbers. Following the last detail card of a sub-class is the sub-class control card, Exhibit No. 19. This card is a summary of all the detail cards pertaining to that sub-class.

The Materials and Supplies statements are compiled from these cards. The postings are coded (R, P and D) so that they can be classified as to receipts, miscellaneous priced items and disbursements.

Exhibit No. 18—*"Materials and Supplies Main-Class Control Record"*

The main-class control card is a recapitulation of all sub-class control cards.

The detail cards are balanced monthly with the sub-class control cards which in turn are balanced with the main-class control card. The total of the main-class cards balances with the Materials and Supplies Account in the general ledger.

Checking Tapes

The above tapes are links which connect the postings on the detail control cards with the original forms of entry. These reference tapes are listed from the cards which were used to compile the posting tapes and permit destruction of the cards at any time thereafter.

Exhibit No. 17—*"Materials and Supplies Summary Card"*

Simultaneously with the running of the Stores Material Disbursed Reports, summary cards showing the work order, job, stock number and quantity are automatically punched by a summary punch connected to the tabulating machine. After the tapes have been priced and extended the money value is then punched in these summary cards. These cards, together with summary cards punched from priced item cards, make up report Exhibit No. 22.

Exhibit No. 22—*"Materials Issued from Stock—Distribution to Accounts Tape"*

This report is divided by accounts, i.e., Construction Work Orders, Operating Expense Work Orders, etc., and the following data shown thereon: Work orders in numerical sequence under accounts, stock numbers

in numerical sequence under work orders, quantity and amount of each stock number, and total amount of each work order.

Descriptions are typed in the construction work order detail ledgers from catalogues which are arranged numerically by stock numbers. By typing from a catalogue the descriptions of an item does not vary as it ordinarily would if it were typed from the requisitions which are made out by different individuals. Only the sub-class and description are typed in the operating expense ledgers.

A great amount of typing as well as other incidental work such as adding and balancing the requisitions daily is eliminated by typing from the summarized tapes instead of typing each requisition.

The total of this report equals the total of the miscellaneous priced item tapes plus the stores material disbursed tape. A journal entry is made from the distribution sheets which charges the various accounts and credits the Materials and Supplies Account in the general ledger.

Exhibit No. 8—*Warehouse Checking Tapes*

These tapes are listed by warehouse and by stock number. They are compiled from the tabulating cards which were punched from the original forms received from the warehouses.

Weekly "material disbursed" and monthly "material received" reference tapes are furnished to the storekeepers, who check the tapes against the warehouse records to verify the postings. The tapes also prove that all forms were received and interpreted correctly by the Accounting Department.

The Stores Office is notified in writing by the storekeeper of any delayed or incorrect tabulations. "Materials and Supplies Correction" form is used to correct all errors.

Exhibits No. 9-10—*"Materials and Supplies Warehouse Balance" Form*

Tabulating cards are punched from the above form at six-month intervals. Tapes, showing thereon the stock number, location, quantity at each location, and total quantity of each stock number at all locations, are tabulated from these cards.

The total quantity of each stock number on hand at all locations as shown by the tape is compared with the Control Card balance. The stock numbers which are out of balance are investigated by the Audit Division.

Monthly reference tapes, upon which are printed in detail and by locations all the transactions posted to the detail control cards, are furnished to the Audit Division.

Postings to the "warehouse record" are made in longhand and the following data are posted: date, reference number, quantity received or disbursed and balance on hand.

Differences between the two records, detail control cards, and warehouse record cards are easily located by means of the reference tapes furnished the Audit Division.

Results Obtained

Our Materials and Supplies Account has been brought into closer agreement with the actual materials and supplies on hand than ever before.

(*Continued on page 71*)

SALES—ELECTRIC REFRIGERATORS

(Household Models Only)

MONTH OF DECEMBER AND TWELVE MONTHS OF 1937-1936

	Month of December 1937	Month of December 1936	Month of November 1937	Twelve Months 1937	Twelve Months 1936
Total United States	109,542	123,208	89,739	2,369,025	2,079,535
Maine	256	421	641	9,124	7,466
New Hampshire	(32)	357	545	7,050	6,616
Vermont	383	214	403	6,107	4,583
Massachusetts	6,501	6,485	5,856	99,393	81,538
Rhode Island	620	826	1,330	13,278	10,569
Connecticut	4,027	2,036	2,254	44,602	35,219
Total New England	11,755	10,339	11,029	179,554	145,991
New York	15,588	13,801	11,966	283,730	244,315
New Jersey	6,505	5,946	4,009	97,029	89,886
Pennsylvania	7,426	10,025	8,584	226,219	189,109
Total Middle Atlantic	29,519	29,772	24,559	606,978	523,310
Ohio	6,846	8,801	7,079	170,965	136,940
Indiana	3,745	3,351	1,279	66,411	58,578
Illinois	8,338	7,337	6,124	184,357	152,337
Michigan	3,587	9,411	4,544	125,545	106,677
Wisconsin	2,780	2,810	2,215	51,908	35,458
Total East No. Central	25,296	31,710	21,241	599,186	489,990
Minnesota	1,383	1,510	2,003	43,037	29,315
Iowa	1,735	733	1,010	35,172	30,286
Missouri	1,411	3,327	1,652	64,966	64,905
North Dakota	231	218	197	4,351	3,403
South Dakota	309	295	154	4,933	5,253
Nebraska	1,244	1,085	694	17,645	18,219
Kansas	984	1,082	877	25,170	24,184
Total West No. Central	7.297	8,250	6,587	195,274	175,565
Delaware	(97)	221	458	5,366	3,965
Maryland	1,888	2,325	803	29,832	23,284
District of Columbia	1,505	1,064	592	20,153	19,622
Virginia	1,647	1,724	980	36,517	32,351
West Virginia	1,462	1,219	659	27,452	25,018
North Carolina	2,077	1,032	732	47,629	37,612
South Carolina	422	576	441	22,549	18,334
Georgia	(173)	810	833	38,428	34,072
Florida	2,276	1,885	1,403	31,841	31,145
Total South Atlantic	11,007	10,856	6,901	259,767	225,403
Kentucky	1,546	1,896	1,207	31,055	27,714
Tennessee	1,320	2,237	559	36,301	32,018
Alabama	1,061	1,714	940	25,855	23,460
Mississippi	445	522	221	11,606	11,389
Total East So. Central	4,372	6,369	2,927	104,817	94,581
Arkansas	402	609	464	12,798	11,907
Louisiana	436	947	517	23,231	20,607
Oklahoma	746	1,353	984	23,123	20,809
Texas	5,141	4,147	2,809	94,240	83,088
Total West So. Central	6,725	7,056	4,774	153,392	136,411
Montana	262	254	273	8,814	9,207
Idaho	319	410	299	9,622	9,607
Wyoming	172	332	87	3,188	3,252
Colorado	927	701	373	15,311	15,389
New Mexico	132	203	98	4,776	3,959
Arizona	331	298	355	8,201	6,236
Utah	642	634	385	12,466	11,967
Nevada	119	(124)	175	2,802	2,728
Total Mountain	2,904	2,708	2,045	65,180	62,345
Washington	1,038	1,604	831	33,336	34,448
Oregon	779	1,747	619	17,925	22,691
California	8,850	12,797	8,226	153,616	168,800
Total Pacific	10,667	16,148	9,676	204,877	225,939

Figures based on report by the NEMA on Net Sales to Dealers and Jobbers.

Impedance of Three Phase Secondary Mains in Non-Metallic and Iron Conduits

By L. Brieger

Assistant Engineer, Consolidated Edison Co. of N. Y., Inc.

A condensed version of a paper presented at the Louisville, Ky., meeting of the Transmission and Distribution Committee, E.E.I., Feb. 9, 1938

A SERIES of tests, dealing with the influence of iron conduits on the impedance of secondary circuits, was conducted on the three-phase, four-wire secondary mains system of the Consolidated Edison Company. It was found that unless the conductors are properly grouped the influence of conduits is appreciable. The most important results of the tests are presented herein.

Consideration of the fundamentals of ac circuit theory indicates that if a circuit is installed in an iron conduit, an increase in the resistance and reactance may be expected. The greater reactance is due to the lower overall reluctance of the flux path because a fraction of the flux lines produced by each conductor will be partly in iron. The increase in resistance is due to the energy losses, partly caused by hysteresis and partly by eddy currents produced by the flux in the iron.

Two types of three-phase secondary mains, in use by the companies associated with the Consolidated Edison System, were tested:

1. Consisting of 3 - 500,000 circular mil phase cables and a neutral.

2. Consisting of 6 - 4/0 B. & S. phase cables and 1 or 2 neutral conductors, each phase consisting of 2 - 4/0 cables. (This "twin circuit" system was described by Searing and Thomas in the Transactions of the A.I.E.E., Volume 52, 1933, Pages 114 to 120.)

In order to ascertain definitely whether iron conduits measurably affect the impedance, preliminary tests were made in the laboratory under controlled conditions and the influence of various factors, such as the size of the duct, arrangement of cables, and magnitude of current was studied separately. To supplement the laboratory tests, a series of field tests was conducted on numerous sections of mains installed in the regular routine of construction work to obtain the combined effect of the variables under actual operating conditions. Both the laboratory and the field studies included measurements of impedance to positive, negative and zero sequence currents.

The outstanding facts obtained by the laboratory tests are assembled in Table I. The results of the field measurements are summarized in Table II. From the data given in these tables

Table I and II.

IMPEDANCE OF 3 PHASE SECONDARY MAINS IN NON-METALLIC AND IRON CONDUITS.

TABLE NO. I: SUMMARY OF LABORATORY TESTS

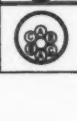
MAINS	(A) POSITIVE AND NEGATIVE SEQUENCE IMPEDANCE (AVERAGE OF 3 PHASES MEASURED WITH BALANCED 3 PHASE LOAD, 60 ∿) CONDUCTOR ARRANGEMENT	DUCT MATERIAL	DUCT SIZE	PHASE CABLES	RESISTANCE AT 25° C. %	REACTANCE %	RESISTANCE AT 25° C. MICROHMS PER FOOT	REACTANCE MICROHMS PER FOOT	(B) ZERO SEQUENCE IMPEDANCE, 60 ∿ NEUTRAL	DUCT	PHASE CABLES	RESISTANCE AT 25° C PHASE CONDUCTORS	RESISTANCE NEUTRAL	RESISTANCE OVERALL	REACTANCE PHASE CONDUCTORS	REACTANCE NEUTRAL	REACTANCE OVERALL
												MICROHMS PER FOOT					
3-500,000 C.M.		FIBRE	4"	N.L.	100.0Ⅱ	100.0Ⅱ	22.3	29.2	1-4/0	FIBRE	N.L. L.	23.0	169.0	192.0	27.0	115.0	142.0
		IRON	4"	N.L.	104.0	119.0	23.2	34.8	1-4/0	IRON	N.L. L.	165.0✞	2.0	167.0	129.0	1.0	130.0
		FIBRE	4"	N.L.	100.0	118.5	22 3	34.6	1-4/0	FIBRE	N.L. L.	23.0	123.0	146.0	15.0	56.0	71.0
		IRON	4"	N.L	107.2	160.0	23 9	46.8	1-4/0	IRON	N.L. L.	130.0✞	2.0	132.0	64.0	4.0	68.0
6-4/0		FIBRE	4"	N.L.	100.0Ⅱ	100.0Ⅱ	24.8	14.2	1-4/0	FIBRE	N.L. L.						
		IRON	4"	N.L	101.0	108.0	25 1	15.3	1-4/0	IRON	N.L. N.L. L.	26.0† 150.0✞ 74.4✞	155.0 0.0 52.8	181.0 150.0 127.2	8.5 100.0 36.6	120.0 0.0 11.4	128.5 100.0 48.0

TABLE NO. 2 SUMMARY OF FIELD TESTS (AVERAGE OF TESTS FOR EACH TYPE OF CONSTRUCTION)

MAINS SYSTEM	MAINS CONDUCTOR ASSEMBLY	(A) POSITIVE AND NEGATIVE SEQUENCE IMPEDANCE, 60 ∿ DUCT MATERIAL	DUCT SIZE	PHASE CABLES	RESISTANCE AT 25° C. %	REACTANCE %	RESISTANCE AT 25° C MICROHMS PER FOOT	REACTANCE MICROHMS PER FOOT	(B) ZERO SEQUENCE IMPEDANCE, 60 ∿ NEUTRAL	DUCT	PHASE CABLES	RESISTANCE AT 25° C. PHASE CONDUCTORS	RESISTANCE NEUTRAL	RESISTANCE OVERALL	REACTANCE PHASE CONDUCTORS	REACTANCE NEUTRAL	REACTANCE OVERALL
												MICROHMS PER FOOT					
3-500,000 C.M.	UNCABLED*	FIBRE	4"	N.L.	102.2	122.6	22.8	35.8	1-4/0 BARE	FIBRE	N.L.	20.0	164.0	184.0	24.0	129.0	153.0
				L.	107.7	122.0	24.0	35.6			L.	24.0	123.0	147.0	18.0	54.0	72.0
		IRON	4"	N.L.	115.0	148.2	25.6	43.3		IRON	N.L.	123.0	15.0	138.0	58.0	8.0	66.0
				L	132.8	153.0	29.6	44.7	1-500,000 C.M. BARE	IRON	N.L. L.	74.0	28.0	102.0	108.0	41.0	146.0
	CABLED*	FIBRE (a) IRON	4"	N.L.	108.0 114.2	109.5 121.0	23.6 25.5	32.0 35.4	1-500,000 C.M. BARE	FIBRE IRON	N.L.	25.0 82.0	77.0 19.0	102.0 101.0	25.0 94.0	82.0 20.0	107.0 114.0
		FIBRE (b) IRON	3"&4"	N.L.	115.8 122.5	93.0 102.8	25.8 27.3	27.2 30.0	3-3/0 BARE	FIBRE IRON	N.L.	23.0 60.0	66.0 22.0	89.0 82.0	23.0 44.0	17.0 6.0	40.0 50.0
6-4/0	UNCABLED*	FIBRE	3"&4"	N.L.	103.2	135.0	25.6	19.2	1-4/0 BARE	FIBRE	N.L. L.	27.0	165.0	192.0	20.0	130.0	150.0
		IRON	3"&4"	N.L.	110.3	202.5	27.2	28.8	2-4/0 BARE	IRON	N.L. L.	87.0 104.0	47.0 27.0	134.0 131.0	81.0 46.0	47.0 16.0	128.0 62.0
				L.	109.5	150.5	27.0	21.4			N.L. L.	100.0	19.0	119.0	100.0	17.0	117.0
	CABLED*	FIBRE IRON	4"	N.L.	105.5 105.5	105.5 112.5	26.0 26.0	15.0 16.0	1-500,000 C.M. BARE	IRON	N.L. L.	24.0	70.0	94.0	0.0	68.0	68.0

Ⅱ 100% REPRESENTS THE OPTIMUM VALUES OBTAINED IN THE LABORATORY ALL OTHER PERCENTAGES REFERRED TO THESE VALUES.

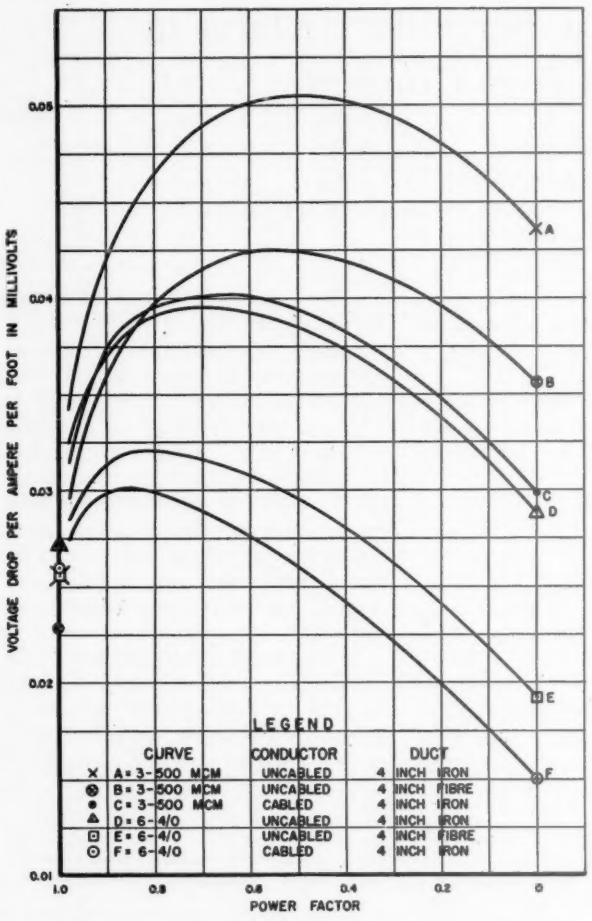
* UNCABLED ASSEMBLIES CONSIST OF SINGLE CONDUCTOR CABLES LAID PARALLEL ON A COMMON REEL (EXCEPTING THE NEUTRAL) AND PULLED INTO THE DUCT THROUGH A "PULLING HEAD" WHICH HOLDS THE CABLES, AS THEY ENTER THE DUCT, IN THE DESIRED SEQUENCE. FOR 6-4/0: A-B-C-A-B-C, WITH THE NEUTRAL IN THE CENTER THE CABLED CONDUCTORS ARE FORMED INTO A COMPACT ASSEMBLY IN THE FACTORY, WITH A LAY OF ABOUT 3 FEET.

† NEUTRAL CONDUCTOR ISOLATED FROM CONTACT WITH THE DUCT

✞ " " SOLIDLY BONDED TO THE DUCT AT BOTH ENDS.

N.L. = NON-LEADED PHASE CABLES

L. = LEAD COVERED PHASE CABLES.



VOLTAGE REGULATION OF NON-LEADED SECONDARY MAINS AT BALANCED 3 φ LOAD

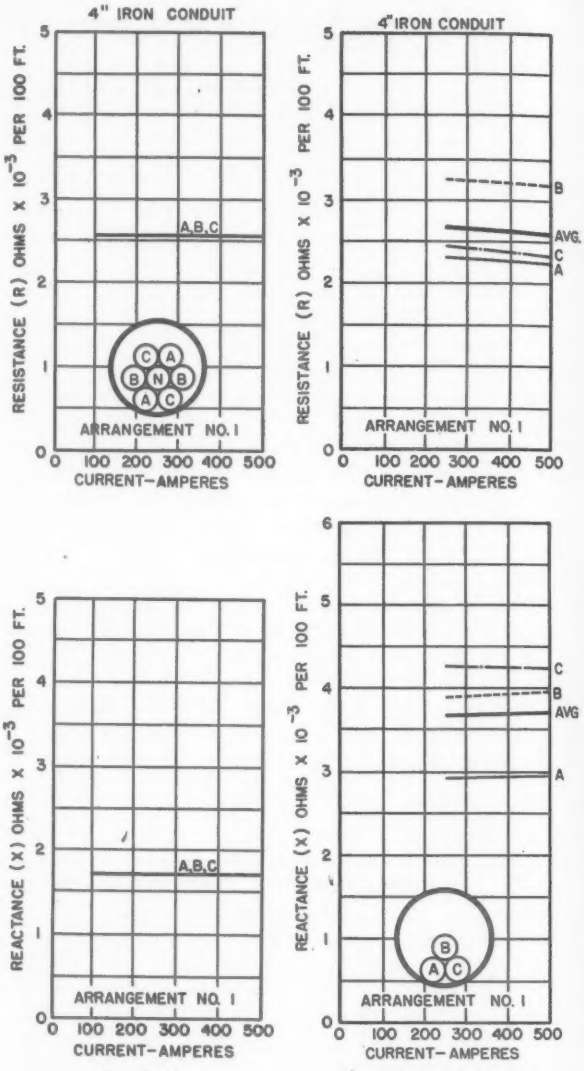
Fig. 1.

Fig. 1 was prepared giving the voltage regulation as a function of load power factor for the most important types of construction.

In brief, the following general conclusions are warranted:

1. The impedance is higher in iron ducts than in non-metallic conduits.
2. The increase depends upon the arrangement of the conductors. A compact, symmetrical circuit is less influenced than a haphazard, loose group.
3. The twin circuit (6 - 4/0) system is less affected than the single circuit (3 - 500,000 cm) mains.
4. The reactance is increased considerably more than the resistance.

Hitherto, manufacturers supplying secondary mains cables for the Consolidated Edison System have shipped all phase conductors of the three-phase system on a common reel in order to facilitate handling during installation. Although pulled into the duct in the proper configuration, the individual conductors, if they are not held together, fall more or less at random within the duct, as indicated by the higher impedance found on a number of field tests. A simple way out of this difficulty is to cable (twist) the conductors before winding on the reel. As it is not necessary to use binders or overall braiding, the cabled assembly can be purchased at no increase in cost. There is a slight additional investment due to shrinkage of one to two per cent, caused by the spiraling, but this is more than offset by the improved regulation, particularly in iron conduits.



LABORATORY TESTS ON PREARRANGED GROUPS OF 3 PHASE LEADED MAINS

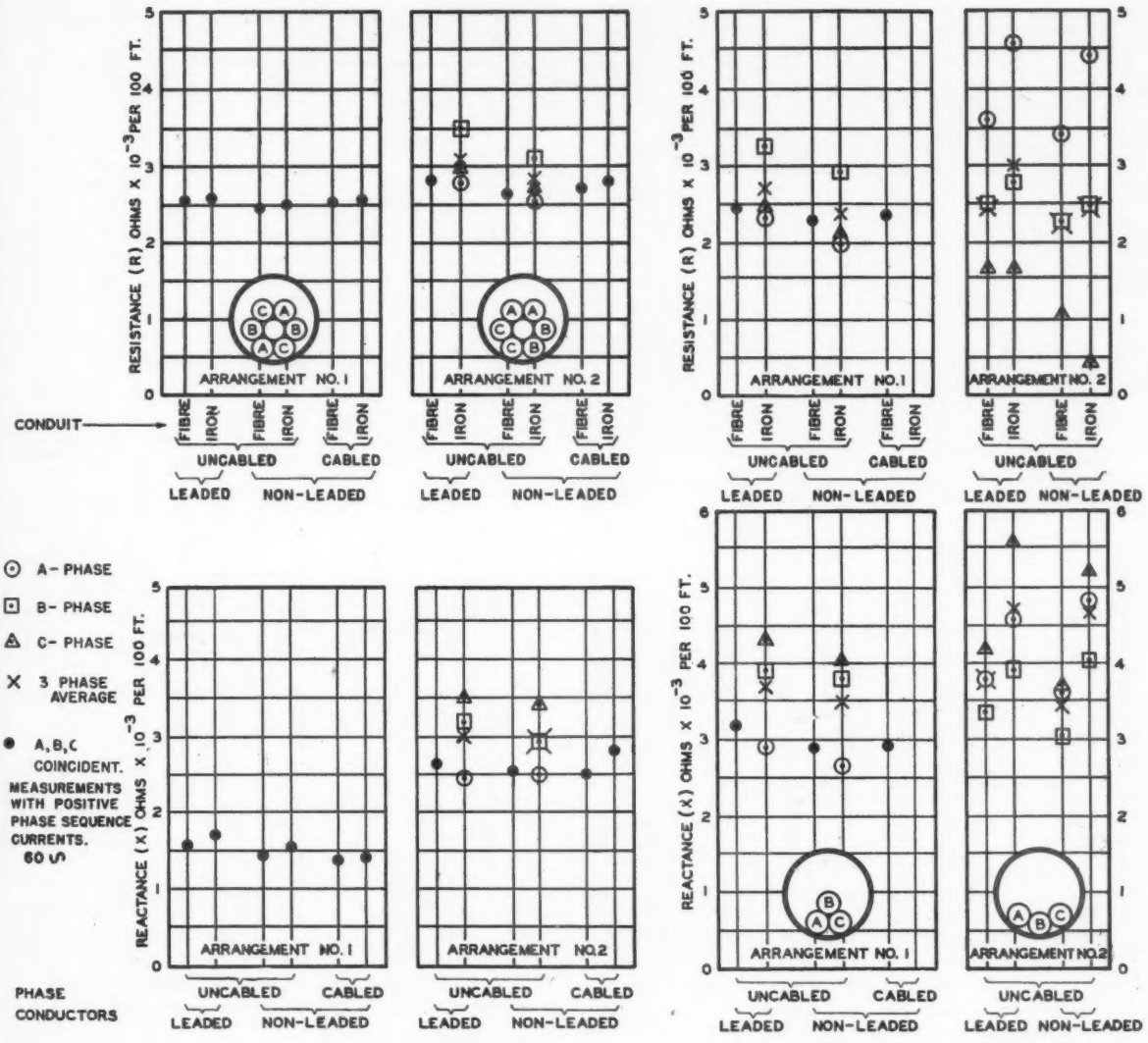
Fig. 3.

Test Methods

A sensitive ac bridge circuit was used for the laboratory tests. The measurements are accurate to about one per cent. Care was taken to reduce the effect of stray magnetic fields to a minimum. For field tests the voltmeter, ammeter, wattmeter method of measurement was employed at first, giving an estimated accuracy of about five per cent, later, when it was found that stray fields did not disturb the measurements, the more accurate bridge was employed.

Measurement of "Phase Sequence" Impedance

For the measurement of the positive and negative sequence impedances balanced three-phase loads of the proper phase sequence were used. To retain the usefulness of the method of symmetrical



LABORATORY TESTS ON LEADED AND NON-LEADED SINGLE CONDUCTOR CABLES HELD IN PREARRANGED GROUPING BY BINDERS TEST CURRENT : 250 AMPS BALANCED 3 PHASE

Fig. 2.

coordinates, the average of the three-phase impedances may be used as the positive and negative sequence parameters of the circuit with reasonable accuracy, although the three-phase impedances were often substantially different. The average of the three impedances was found practically the same for positive and negative sequence current. In circuits consisting of numerous sections, the use of averages will cause little or no error because of the probability that each phase will contain an equal number of sections with high, low and medium values of impedance.

For the measurement of zero sequence impedances the usual method was employed, which consists of passing a single-phase load through the neutral in series with the phase conductors, all phase conductors being connected in parallel.

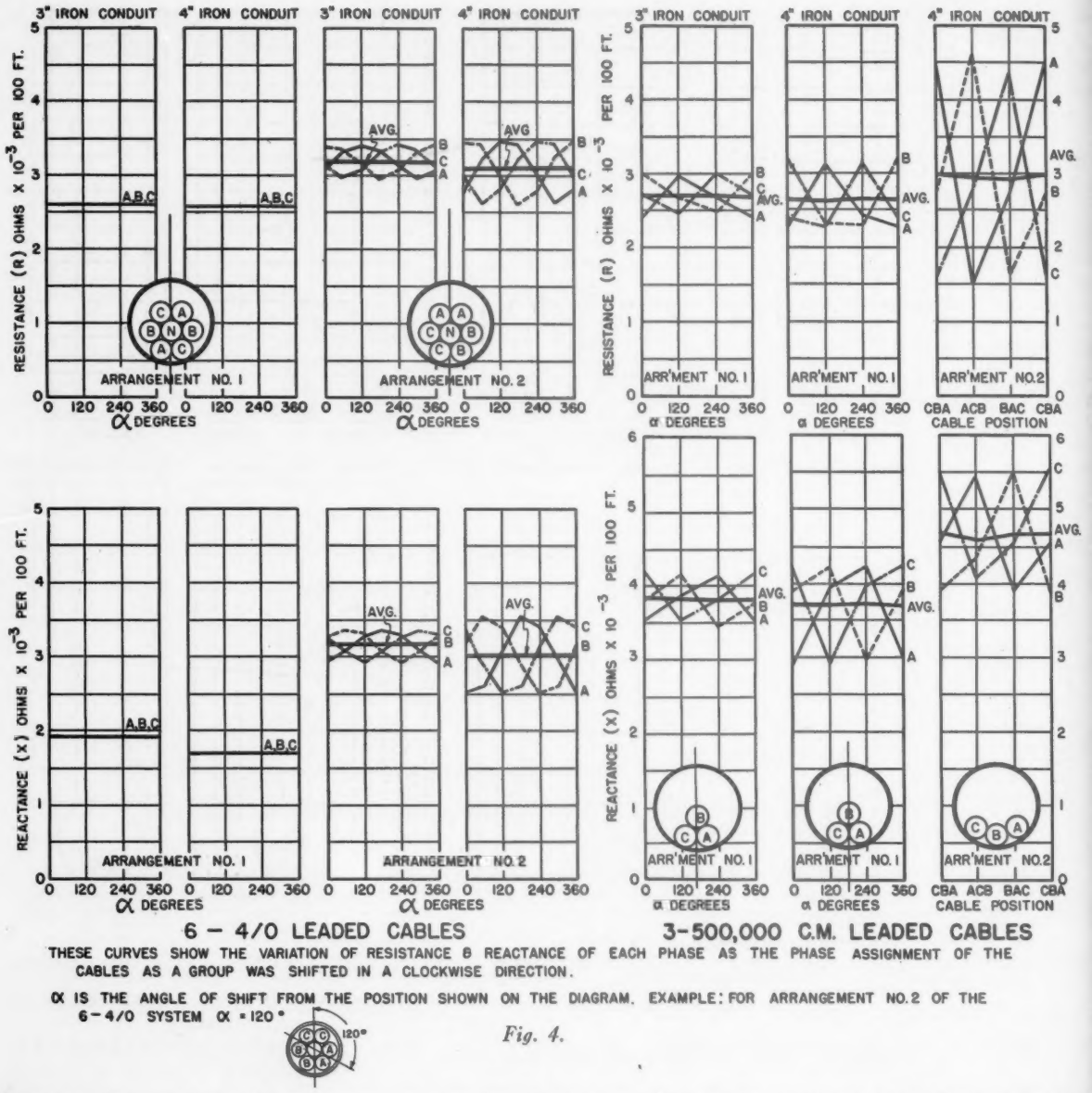
Positive and Negative Sequence Impedance

(A) *Laboratory Test*

On Fig. 2 is shown the impedance of three-phase mains at 250 amperes balanced three-phase current, for the following types of construction:

(a) Lead covered, single conductor cables.
(b) Non-leaded (rubber insulated, and braided) single conductor cables.
(c) Non-leaded conductors cabled together to form a permanent assembly in the ducts.

The twin circuit (60-4/0) system was investigated under several possibilities of phase disposition two of which are shown on the figure; for the single circuit (3-500,000 cm) system, two general arrangements were studied, the



THESE CURVES SHOW THE VARIATION OF RESISTANCE & REACTANCE OF EACH PHASE AS THE PHASE ASSIGNMENT OF THE CABLES AS A GROUP WAS SHIFTED IN A CLOCKWISE DIRECTION.

α IS THE ANGLE OF SHIFT FROM THE POSITION SHOWN ON THE DIAGRAM. EXAMPLE: FOR ARRANGEMENT NO. 2 OF THE 6-4/0 SYSTEM α = 120°

Fig. 4.

three-phase cables grouped triangularly and in a flat row. For the positive and negative sequence tests, either no neutral was pulled into the ducts or the neutral was left floating (6-4/0 system) and isolated from the duct so as to eliminate the effect of circulating currents induced in the neutral.

If the six-phase conductors of the twin circuit system are held in the proper configuration (No. 1 on Fig. 2), the influence of the iron conduit on the impedance is slight and the impedances of all three phases remain practically equal. For other configurations of the twin circuit system, the effect of the iron is larger and the presence of the conduit may unbalance the phase impedances or, where the phases are inherently unbalanced, the inequality of the impedance is increased by the conduit.

Compared with the twin circuit system, the single circuit mains are affected to a greater extent, even if the conductors are held in a compact triangle.

There is no substantial difference in the effect of iron conduit between leaded and non-leaded cables.

Only a fraction of the flux surrounding any of the conductors penetrates the iron and as the path of even this fraction is largely in air, the reluctance of the magnetic circuit at any instant of the cycle should be nearly independent of the magnetizing force, i.e., the current. Correspondingly, the impedance for any one circuit configuration should be practically independent of the load, as indeed was found to be the case (Fig. 3).

On Fig. 4 are shown:

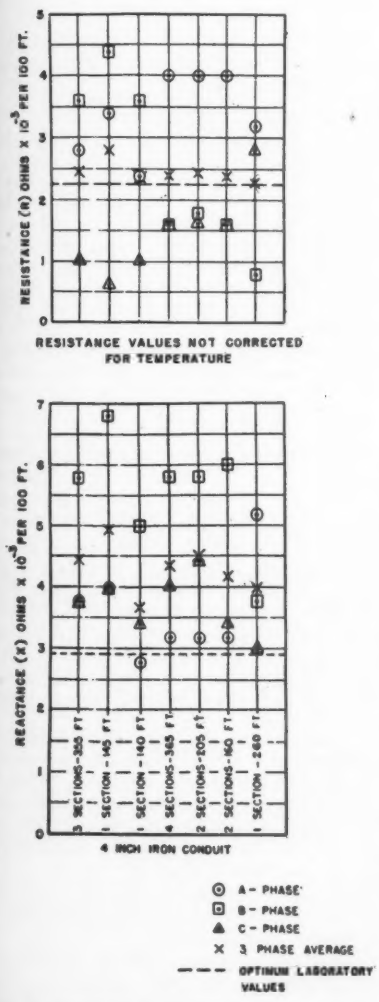
(1) The effect of the relative position between the duct and the tables.

(2) The effect of the size of the iron conduit on the impedance.

The information on this figure was obtained by holding the conductors together in the arrangements shown and rotating the phase assignment of the conductors. While the average of the three-phase impedances remains practically constant, the individual impedances change materially, depending on the relative position of that phase in the duct. It is also observable that in a smaller

conduit the average resistance and average reactance are somewhat larger but the variation of each phase-impedance with the shifting of the phase assignment is smaller.

The impedance to balanced three-phase loads may be influenced by the neutral circuit if the latter is subdivided and forms a closed loop. For example, in the case of a cabled assembly consisting of 3-500,000 cm phase conductors and 3-3/0 sector shaped neutrals (shown on Fig. 6) in iron conduit, the positive and negative sequence resistances were about 12.5 per cent more and the reactances 11.0 per cent less when the three neutrals were tied together as against the values measured when the three neutrals were separated. Contact between neutrals and conduit was prevented. The change of impedance is caused by the circulating current produced in the loop by the unequal voltages induced in the neutral branches.


RESISTANCE (R) OHMS X 10⁻³ PER 100 FT.
RESISTANCE VALUES NOT CORRECTED FOR TEMPERATURE
REACTANCE (X) OHMS X 10⁻³ PER 100 FT.
3 SECTIONS - 350 FT
1 SECTION - 145 FT
1 SECTION - 140 FT
4 SECTIONS - 345 FT
2 SECTIONS - 205 FT
2 SECTIONS - 160 FT
1 SECTION - 260 FT
4 INCH IRON CONDUIT
A - PHASE
B - PHASE
C - PHASE
3 PHASE AVERAGE
OPTIMUM LABORATORY VALUES

FIELD TESTS ON 3-500000 CM. NON-LEADED UNCABLED MAINS

Fig. 5.

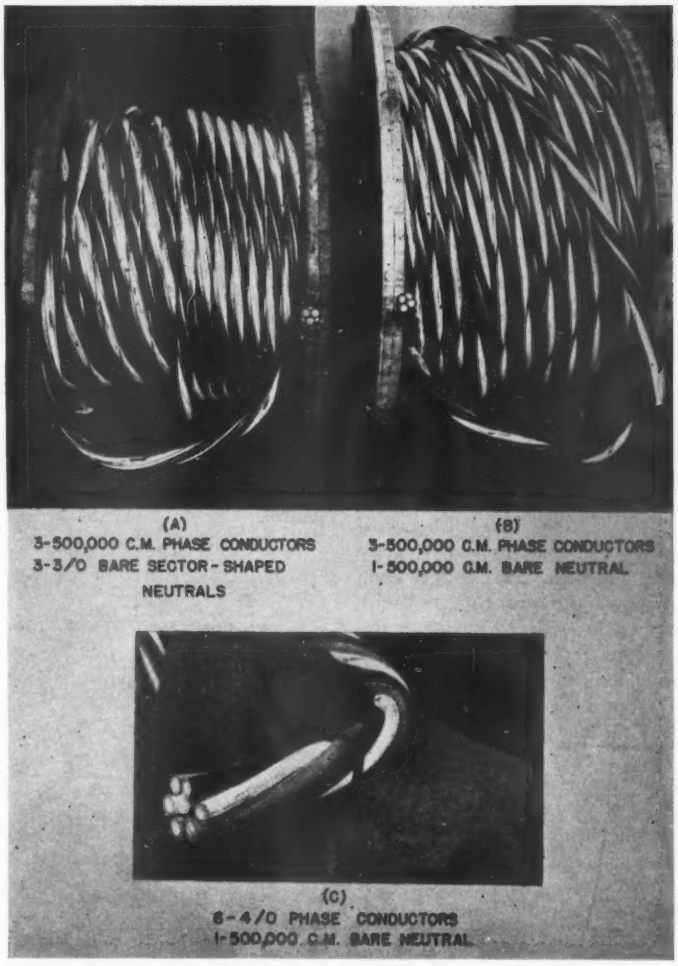


Fig. 6—Cabled Assemblies of 3-Phase Non-Leaded Secondary Mains.

(B) *Field Tests*

Qualitatively, the field and laboratory tests are in substantial agreement. Field data collected on one type of construction are shown on Fig. 5. In some instances, the effect of the iron conduit was found to be in excess of the amount obtained in the laboratory, undoubtedly due to the more haphazard position of the cables in the duct. It is significant that the impedance of the twin circuit system of mains is also affected by the iron conduit, although the cables were pulled into the duct in the correct arrangement. Evidently, that alone is not sufficient because in a spacious conduit the cables may fall to the bottom of the duct in a more or less random position. This is substantiated by the data obtained on non-leaded and leaded cables. The non-leaded conductors occupy less space; there is a better chance of random disposition in the ducts, consequently the impedance of non-leaded cables is affected to a greater degree than the impedance of leaded cables.

The results of the field tests emphasize strongly the advantages of keeping the cables in proper arrangement within the duct. Trials are being made at the present time with cabled conductors assembled at the factory on a common reel. Some experience is already available on cables of this type in the field and the results have been good. Pulling is easy. The cables stay together and the effect of the iron conduit on the impedance of the twin system of mains is negligible and the effect on the single system of mains is small. Several methods of assembly are illustrated in Fig. 6.

Zero Sequence Impedance

(A) *Laboratory Tests*

It is important to note that the effect

of the iron duct on the zero sequence impedance is twofold:

(1) As in the case of 3 phase load, the leakage flux is changed due to the presence of magnetic material.

(2) If the conduit is in contact with the neutral, a part of the current is by-passed through the duct, thereby completely changing the mutual induction between the conductors of the circuit. In the case of 6 - 4/0 non-leaded cables with a 4/0 neutral in a 4" iron conduit, it was found that approximately 20% of the current is by-passed by the duct.

To study the effect of duct current, measurements were made with the neutral insulated and alone carrying the return current and also with the neutral and the conduit solidly bonded at both ends. A typical test of this nature is shown in Table IB under the 6-4/0 system of mains for non-leaded uncabled conductors. The tests marked with a † were made with the neutral isolated from the conduit, while the tests marked with a ‡ were made with the neutral and the conduit bonded together. Obviously the overall resistance and reactance of the entire circuit is somewhat smaller when both the neutral and the conduit carry current. There is, however, a marked change in the division between the impedance of the phase conductors and the neutral. When only the neutral carries current, the resistance and the reactance of the phase conductors is much smaller than the corresponding parameters of the neutral, whereas practically all the resistance and reactance appear on the phase conductors when the neutral and the conduit are tied together. This phenomenon should be considered in problems involving the determination of neutral shift under unbalanced loading.

In time data will be available for all types of construction included in Table IB.

(B) *Field Tests*

Because of the use of bare neutral conductor, there is a good likelihood of contact between the conduit and neutral. There were, however, comparatively large variations in individual cases, undoubtedly due to the differences in the firmness of contact between the neutral and the conduit. In addition, at several locations the secondary neutral could not be readily isolated from the neutrals of other circuits with the result that the measured impedances were smaller than the data obtained in the laboratory.

A large variety of neutral conductors were involved in the field tests owing to a recent change in the practice of the company. Formerly a single 4/0 bare conductor was used for neutral with the 6-4/0 as well as with the 3-500,000 cm mains. Considerations of short circuit protection made it desirable, however, to increase the current carrying capacity of the neutral of non-leaded mains. Some of the more recent tests were made on this newer system.

SPECIFICATIONS OF MATERIAL USED IN TESTS

MAINS

Size	Type	Insulation Thickness - Mils Rubber	Lead	Specified Maximum Overall Diameter† Inches
500,000 CM	Leaded	94	94	1.31
	Non-Leaded	94	—	1.23
4/0 B. & S.	Leaded	78	78	0.95
	Non-Leaded	78	—	0.90
	NEUTRAL			
500,000 CM	Bare	—	—	0.81
4/0 B. & S.	Bare	—	—	0.52

CONDUIT

Nominal Size	Material	Diameter - Inches Inside	Outside
4 Inch	Fibre	4.063	4.687
3 Inch	Iron*	3.068	3.500
4 Inch	Iron*	4.026	4.500

† Actual dimensions are 10-20% smaller.
* Chemical analysis — 0.08% — 0.12% Carbon.

Edison Electric Institute Medals

(*Continued from page* 55)

around on the other side of the pole to change pin on the other end. He slipped the steel pin in place over the arm and reached out with his crescent wrench to tighten nut on strap, when his right shoulder came in contact with uninsulated phase of 2300-volt circuit.

George R. Shoemaker, who was working on the pole with Liller, pulled him away with his gloved hand. He held Liller in an upright position until another lineman, Adren C. Rinehart, climbed the pole and assisted in lowering Liller to the ground. Liller was carried to the porch of a nearby house and Rinehart immediately started artificial respiration. After about five minutes Liller regained consciousness and after receiving first aid treatment for burns was removed to the hospital.

The Edison Electric Institute Medal and Certificate, and miniature Medals to those who participated in the Resuscitation, were presented to the Potomac Edison Company Keyser District Line Crew on Jan. 4, 1938, by Mr. George S. Humphrey, Vice-President of the West Penn Power Company.

LINE CREW
Pennsylvania

On July 10, 1937, Clark Updegraff, lineman 1st class, employed by the Edison Light and Power Company, received an electric shock while dead-ending a primary 4600-volt wire on a creosoted pine pole in York, Pa. He was first noticed lying against the primary wire, unconscious, and it is believed he made contact with the conductor when his wet sleeve, about his rubber glove, came in contact with the section of wire on which he was working. His body was pulled from the wire and lowered to the ground with a hand line by members of the line crew.

The Schafer Prone Pressure Method was first applied by Jerry Swan who was relieved by Samuel Harmon. Others assisted by rubbing the injured man's arms and legs, loosening tight clothing, etc. After ten minutes application of artificial respiration Updegraff breathed without assistance.

At a safety meeting of about sixty employees of the Company on Jan. 26, 1938, Mr. J. E. Wayne, President and General Manager, presented the Crew with a Medal and Certificate. Miniature medals were presented to Messrs. F. W. Hinea, foreman, Jerome Noel, Jerry Swan, Samuel Harmon and Harry Kurtz, who constituted the line crew.

D. D. RHAME
South Carolina

During a lightning storm on June 7, 1937 at 9 p. m., J. M. Swearingen, a lineman employed by the South Carolina Power Company, had re-fused a switch on pole at Ladies Island Bridge, Beaufort, S. C. He unfastened his safety belt and was coming down the pole when a flash occurred, causing him to fall to the ground.

D. D. Rhame, local superintendent of the South Carolina Power Company, was standing on the ground near the pole. He saw that Swearingen was unconscious and not breathing, and immediately started artificial respiration. After ten minutes application, the patient showed signs of life. He suffered burns of right forearm and wrist, of thumb, palmar surface, left hand; contusions of chest, both legs, etc.

Mr. E. L. Godshalk, President of the Company, presented the Edison Medal to Mr. Rhame on Jan. 20, 1938 at a meeting of the employees of the Company held at Denmark, S. C. The local papers carried publicity regarding this presentation.

Prime Movers Committee Meeting

W. E. Caldwell, *Chairman*

THE third meeting of the Prime Movers Committee was held Feb. 7-8, at the Netherland-Plaza Hotel in Cincinnati.

The Chairman announced the appointment of Mr. E. T. Cope as Prime Movers Committee representative on the A.S.T.M. Committee on Thermal Insulation.

Mr. H. M. Cushing related the cause of the recent electrical failure at Huntley Station and the steps taken to restore 60-cycle service to the city of Buffalo.

A discussion on means of obtaining information for technical reports resulted from questionnaire criticism and helpful suggestions were offered.

Mr. C. H. Fellows spoke briefly on the work of the Chemistry Subcommittee and mentioned the progress of the A.S.M.E. Joint Research Committee on Boiler Feedwater at College Park, Maryland. Comment was also made on embrittlement studies and the work of Professor Straub at the University of Illinois.

Mr. J. F. Muir presented a general statement for the Combustion Subcommittee and called on Messrs. Drabelle, Cushing, Luce, and Tenney for progress reports on stokers, combustion control, mechanical draft, furnaces and pulverized fuel.

Mr. E. R. Crofts reported on the work of the Turbines Subcommittee and circulated for review a summary of the material received to date.

The work of the Oil and Gas Engines Subcommittee was outlined by Mr. J. M. Drabelle. It was suggested that comments from the commercial departments of member companies on Diesel engine outage data would assist in determining whether the amount of work involved in its preparation was justified.

Due to the unavoidable absence of Mr. J. R. Baker, Chairman of the Boilers Subcommittee, a progress report prepared by him of the work of his Subcommittee was presented by the Secretary.

On Monday evening, many of the members of the Committee visited the West End Station and inspected the new high pressure installation. Invitations were extended to the members to visit the Millers Ford plant of the Dayton Power and Light Company, as well as the manufacturing plants of the Lunkenheimer Company and the Wm. Powell Valve Company, following the conclusion of the meeting.

Tuesday morning was devoted to the Round Table discussion of common problems.

Announcement was made that the next meeting of the Prime Movers Committee would probably be held in Chicago, May 2-3.

Electrical Equipment Committee Meeting

J. F. Fairman, *Chairman*

THE winter meeting of the Electrical Equipment Committee was held in Cincinnati, Ohio, Feb. 7-8. Twenty-five members of the committee were present as well as about thirty visitors. On Monday morning the committee held its usual closed session where apparatus troubles were reviewed. In addition, a discussion was held of the operation of the new 3600 rpm hydrogen cooled generators at New York, Dayton and Logan, W. Va. There have been some minor difficulties in the initial operation of some of these machines, but at the present time these seem to be largely worked out and the general opinion expressed was that entirely successful operation would be shortly obtained.

The application made on behalf of the industry before the Federal Communication Commission for allocation of radio frequencies for power emergency use was favorably acted upon and certain frequencies were allocated for this service in the order of the Commission issued Oct. 15, 1937. The Radio Committee attended an informal hearing on rules in January and reported at this meeting that the Commission representatives at the meeting appeared to receive their suggestions favorably and that there is every reason to believe satisfactory rules for the use of these frequencies by power companies for emergency dispatching will shortly be available.

A paper presented by Mr. H. C. Marcroft, giving the results of tests on generator insulation at Holtwood, presented a new attack on the study of means for determining the condition of generator insulation without destructive tests. Mr. Marcroft's tests were conducted by measuring the insulation resistance for definite periods of time with direct current from batteries of 500, 1000 and 1500 volts impressed on the insulation. Although no definite conclusions can yet be drawn this is another method of attack on this difficult problem and it is hoped that by such continued study a satisfactory answer will be found.

Mr. A. M. deBellis' paper on the new bus structure of Waterside station described the development of metal-clad switchgear for installation in an existing switchhouse to provide for about double the station capacity for which the switchhouse was originally built in 1905, and also to fulfill the present day requirements for reliability of service. Mr. H. B. Wood presented a paper showing how bus differential protection for bus ground faults had been installed in the Williamsburg Power Station to provide increased protection for the station with minimum structure modification.

Mr. H. L. Wallau described the new Grant Substation where metal-clad gear had been extensively used for a high capacity substation in order to reduce the construction time which would otherwise have been required for a larger building and the installation of the conventional gear in the building after completion. Metal-clad gear is largely factory built and assembled, and its installation required considerably less time.

Mr. R. A. Hentz presented a final report on Design of Switchhouses and Switchyards. This report presents the most recent engineering thought for the design of these important structures and shows the layouts used by many companies. The most interesting single item is the marked trend for greater segregation and isolation of this equipment into small sections so that an accident to any one section will not result in a serious crippling of the system.

Mr. A. S. Douglass and Mr. L. W. Clark presented a paper on Power Supply for Welders. This paper shows the importance of welding to the central station industry, the demand taken by various types of welders, and their power consumption. The discussion following this paper was entered into by many members of the committee who have

been faced with problems for measuring the demand and energy consumption of this type of equipment. Also, the problems of a proper rate for the supply to this equipment was discussed, as frequently special construction and equipment is required on the part of the utility to render this service and prevent serious interference with the service of other customers.

Mr. H. C. Forbes presented a paper on Generating System Capacity Reserves. This paper gives the results of a statistical study of the probability of the outages of generators on a large system and provides a logical basis for determining the reserve capacity to adequately insure service continuity.

A round table discussion was held of the papers on Continuing Property Records, which were presented at the October meeting. In this discussion the members presented the difficulties which they have encountered in the setting up and operating of continuous property records.

The next meeting of the Electrical Equipment Committee will be held at the Edgewater Beach Hotel in Chicago on May 2 and 3.

Transmission and Distribution Committee Meeting

H. P. Seelye, *Chairman*

THE second meeting of the Transmission and Distribution Committee for the current administrative year was held at the Brown Hotel, Louisville, Ky., Feb. 9-10. Thirty of the forty-three members were present or represented. This meeting was also attended by 115 others, most of whom are associated with power companies.

A meeting of the group sponsors was held on the afternoon and evening of Feb. 9, at which future plans of the committee were discussed. This was the first meeting of the committee since the formation of a new group, the Cooperative Projects Group, under the sponsorship of M. D. Hooven, Public Service Electric & Gas Company.

The forenoon session of Feb. 9 was devoted to:

1. A report and outline of the functions of the Cooperative Projects Group. The main purpose of this group is to follow the study of those subjects that are of joint interest to the Transmission and Distribution Committee and other committees of the Institute and avoid the duplication of effort insofar as the Transmission and Distribution Committee is concerned. This includes such subjects as property accounting, service characteristics, protection of persons, property and equipment, meters and services, and the correlation of design to character of use. Sponsors for most of these subjects have been appointed from the committee membership.

2. The Overhead Distribution Group presented the following papers and discussions: Design of Wound Core Transformers, by E. D. Treanor of the General Electric Company; Calculations for Line Design, by A. K. MacNaughton, Commonwealth & Southern Corporation; and reports on Kinds of Distribution Transformer Loads, by M. W. DeMerit, West Penn Power Company.

The afternoon session was given over to papers and discussions that had been arranged by the Underground Group with C. W. Franklin, sponsor, and the Standards and Specifications Group under E. V. Sayles, sponsor.

Two papers were presented under the Underground Group. The first of these was by P. W. Crosby and J. A. TenBrook, both of the Philadelphia Electric Company, on A Decade of A-C Network Operation in Philadelphia. The other paper was by L. Brieger, Consolidated Edison Company, on Impedance of Conductors in Ducts.

The program of the Standards and Specifications Group included a paper by H. H. Rodee, Aluminum Company of America, on Sags and Tensions in Aluminum Conductors, and several progress reports from sub-committees that are making studies on specific assignments. This session was adjourned at 3.30 p.m. to permit an inspection trip to the pole treating plant of the Brown Wood Preserving Company in the vicinity of Louisville.

The forenoon of Feb. 10 was devoted to meetings of individual group and subject sessions. These were parallel sessions and provided an opportunity for those interested in specific lines of work to participate in discussions of subjects of their choice. The following sessions were held:

(a) Underground Group—Sub-Committee on Underground Equipment and Methods. The program of this session included the following:

1. An Enclosed Network Protector Fuse, by W. Perine, Consolidated Edison Company of New York, Inc.

2. Investigation of the Performance Characteristics of a Number of Corrosion-Preventive Coatings, by Howard S. Phelps, Philadelphia Electric Company.

3. Shielding of Rubber Insulation—IPCEA Findings, by L. F. Hickernell, Anaconda Wire & Cable Company.

4. Operation of Rubber Insulated Non-Metallic Sheather Cable on Underground Secondaries, by C. P. Xenis, Consolidated Edison Company of New York, Inc.

5. IPCEA Lead Bending Test—Progress Report—by I. T. Faucett, General Cable Corporation.

6. Cable Joint Swelling, Bursting and Collapsing, by L. G. Smith, Consolidated Gas Electric Light & Power Company of Baltimore.

(b) The Plant Coordination Group subject session program consisted of a discussion of various problems that fall within the scope of this group and a paper by H. W. Wahlquist, of the Edison Electric Institute, on Inductive Coordination of Rural Power and Telephone Systems. This paper described the various methods that have been given consideration during the past two years and the conditions under which these methods have proved effective. Several sets of tests have been made under field conditions and Mr. Wahlquist summarized the results obtained and explained the application of remedial measures studied in making these tests.

(c) Distribution Economics Subcommittee, with M. W. DeMerit, Chairman, discussed work that had been done and plans for further study on—

1. Economical Distribution Transformer Operation.

2. Methods of Testing Distribution Transformer Loads or Determining Loads.

(d) The Wood Products Subcommittee, L. G. Smith, Chairman, discussed changes which might be necessary in the A.S.A. wood pole specifications and Suggestions for Specifications for Wood Cross Arms.

All of these subject sessions were well attended and the discussions covered numerous current problems that are in need of attention in transmission and distribution work.

The afternoon of Feb. 10 was devoted to a closed session, at which only members and guests who are associated with power companies were present. Reports were presented at this session by the sponsors of groups and subcommittee chairmen.

The next meeting of the Transmission and Distribution Committee will be held during the week of May 2 at Chicago.

T. A. Kenney

T. A. KENNEY, a director and vice-president of the Commonwealth and Southern Corporation, and a member of the Operating Committee of the Edison Electric Institute, died on Jan. 19 after a long illness.

Mr. Kenney entered the electrical industry immediately after leaving school, starting with the Hudson River Power Transmission Company, which subsequently became a part of the Adirondack Water Power Corporation. This early experience, which afforded first-hand experience with the electrical industry included not only high-voltage power transmission, but local electric distribution, industrial power application and electric railway operation.

In 1912 Mr. Kenney became manager of the production and transmission department of the Consumers Power Company of Michigan with headquarters in Jackson. This company was then consolidating a great many widely scattered hydroelectric and steam companies in the state and interconnecting them. This resulted in the development of the large Michigan system of today and brought about successful operation of the first 140,000-volt transmission system in this country.

In 1916 he moved to New York to join the staff of Hodenpyl, Hardy & Company, one of the predecessors of the Commonwealth & Southern Corporation. In addition to being a vice-president of the Commonwealth & Southern Corporation, he was president of Consumers Power Company, Ohio Power Company and Youngstown Municipal Railway Company and an officer of several other companies in the Commonwealth & Southern system.

L. A. Coleman

LAWRENCE A. COLEMAN, executive vice-president of the New York and Queens Electric Light & Power Company, died of a heart attack on Feb. 10 at his home at 301 Loring Avenue, Pelham. He was 61 years old.

Mr. Coleman was born in Long Island City and began work as a junior clerk with the United Electric Light & Power Company in 1891. He occupied many positions until he was made treasurer in 1919. He later became a director and in 1925 he resigned and joined the New York and Queens Company.

He was a director and former president of the Queens Chamber of Commerce, and served as a director also of the Long Island Chamber of Commerce. He served in various electrical associations as an officer and was once chairman of the metropolitan section of the National Electric Light Association.

Howard T. Sands

HOWARD TUXBURY SANDS, former vice-president of the Electric Bond and Share Company of New York and a former president of the National Electric Light Association, died on Feb. 14 at Orange, N. J., Memorial

Hospital after an illness of six weeks. He was 70 years old.

Since his resignation two years ago as vice-president of Electric Bond and Share, Mr. Sands had been the director of the company's extensive holdings in Brazil. During the last ten years he had passed considerable time in Brazil, Chile and Argentina.

A former hotel clerk in a small New England town, Mr. Sands became superintendent of the Lewiston and Auburn Electric Light Company, of Maine, in 1901 and supervised the construction of the Deer Rips hydro-electric development, at that time one of the largest projects in the East.

He was born in Saco, Me., on Sept. 12, 1867. After he was graduated from the Saco High School, he worked for a time as clerk in a Bethlehem, N. H., hotel and later went to the west coast as salesman for a mill supplies firm. Following the panic of 1893 he managed a hotel in Tacoma, Wash., suffered a nervous breakdown from overwork, then returned to New England, where he subsequently took charge of the construction crew at a hydro-electric development at Mechanic Falls, Me.

Although he had no technical training

as an engineer, Mr. Sands took charge of the plant after it was completed and remained as superintendent until 1901. As superintendent of the Lewiston and Auburn Electric Light Company, he passed four years unifying the systems of that company and the American Light and Power Company, which it purchased.

In 1905 he joined the Charles H. Tenney Service Organization, in Boston as manager of the Haverhill Electric Company and in 1910 was appointed general manager of all Tenney properties. He became vice-president in 1914, retaining that position until 1926, when he resigned to become vice-president of the Electric Bond and Share Company. He was elected president of the National Electric Light Association in 1927.

RECENT PUBLICATIONS

BOILERS, SUPERHEATERS, ECONOMIZERS, AIR HEATERS AND PIPING — 1937

E.E.I. Pub. E-16. A report of the Prime Movers Committee, Edison Electric Institute, 56 pages. Price 90c. to members and their employees; $2.35 to non-members in the U.S.A.; $2.50 to foreign countries.

TRENDS in steam-generation practice are reflected in the latest (December, 1937) report of the Boilers Subcommittee of the Prime Movers Committee, Edison Electric Institute. Although this report is, as usual, entitled "Boilers, Superheaters, Economizers, Air Heaters and Piping," the greater part of the report consists of the section devoted to Boiler Availability, which is presented for the first time by this committee in the extensive form found in the present report.

The discussion of boiler availability carries on the work started by Hirshfeld and Moran in 1928 which was summarized in their ASME paper of September, 1933(*). The present report goes into greater detail than the previous papers; in particular it deals with repairs and maintenance not directly affecting present availability, and in this respect it presents a useful practical picture of all of the precautions to be taken with steam raising plant having availability for their ultimate object. Taking the present report and the earlier papers together, an informative record of boiler performance is available for the period 1928-1936, inclusive.

The introduction to the extensive and detailed tables gives the considerations which influenced the committee in selecting the kinds of information, and the degree of detail which was decided upon. Among these considerations are those having to do with the trend in steam generation practice such as: the idea that future steam generating units will probably be of rather large capacity, that the number of them in new stations may be the same as the number of turbines, and as a consequence, that there will be more need, in such installations, to coordinate the operating and maintenance cycle of such steam generators with that of the turbo-generators with which they are associated.

(*) C. F. Hirshfeld and G. U. Moran, ASME Trans. Vol. 55, No. 11, p. 117, Sept. 15, 1933.

CABLE OPERATION—1936

E.E.I. Pub. E-17. A report of the Transmission and Distribution Committee, Edison Electric Institute, 29 pages. Price 60c. to members and their employees; $1.50 to non-members in the U.S.A.; $1.60 to foreign countries.

THIS report contains outstanding facts obtained from a survey of the data submitted by 59 companies on the operation of underground power systems operating at more than 7.5 kv.

The trouble rate for all high voltage equipment (total cable, joint, and pot-head troubles per 100 cable mile-years) during 1936 was 11.9 troubles per 100 cable mile-years, a value 5.3 per cent higher than the 1935 rate which included 43 cable and 14 joint failures on cable subjected to feeder-loading tests. The 5.3 per cent increase in the trouble rate was accompanied by a 12 per cent increase in the failure rate and a 9.2 per cent decrease in the removal rate. The increase in the failure rate causes a sharp reversal in the downward trend noted

Conversion of Wind Velocity to Pressure

IT IS sometimes desirable to convert wind velocity expressed in miles per hour to pressure in pounds per square foot for determining wind loads on various kinds of surfaces. To make this conversion by the usual method, it is necessary to use "actual" wind velocity values.

Prior to Jan. 1, 1932, the records of the United States Weather Bureau were reported in terms of "indicated" velocities, the amount of correction necessary to obtain the corresponding "actual" velocity depending on the type of anemometer used. Since this date, Weather Bureau offices have made the necessary corrections and wind velocity values contained in weather reports have been expressed in "actual" velocity.

From the beginning of wind velocity records in the United States about 1870 to Dec. 31, 1927, the Robinson 4-cup anemometer was used exclusively, and its indications were reported and published at their face value. Hence any one who desires to correct such records needs to apply the rather large correction for the 4-cup anemometer.

From Jan. 1, 1928, to Dec. 31, 1931, the 3-cup anemometer was used exclusively by the Weather Bureau for all records. Hence any records published during these four years may be corrected by applying the small correction for the 3-cup anemometer.

Beginning with Jan. 1, 1932, the Weather Bureau adopted the practice of correcting all indicated values before making them public.

For those who may have occasion to convert wind velocity values as reported by the Weather Bureau prior to Jan. 1, 1932, the proper correction factor may be obtained from the accompanying table, which is taken from Instructions No. 1, of the U. S. Weather Bureau, dated Jan. 2, 1935.

Velocities Indicated		
By 4-cup anemometer, m.p.h. 1870-1927 incl.	By 3-cup anemometer, m.p.h. 1928-1931 incl.	Correction in whole m.p.h.
0 to 8	0 to 16*	+1
9 to 12	17 to 26	0
13 to 16	27 to 35	−1
17 to 20	36 to 44	−2
21 to 24	45 to 52	−3
25 to 28	53 to 61	−4
29 to 32	62 to 70	−5
33 to 36	71 to 79	−6
37 to 39	80 to 87	−7
40 to 43	88 to 96	−8
44 to 47	97 to 105	−9
48 to 51	106 to 114	−10
52 to 54	115 to 122	−11
55 to 58	123 to 132	−12
59 to 62	133 to 139	−13
63 to 65	140 to 149	−14
66 to 69	150 to 157	−15
70 to 73	158 to 166	−16
74 to 77	167 to 174	−17
78 to 80	175 to 184	−18
81 to 84	185 to 192	−19
85 to 88	193 to 200	−20
89 to 91		−21
92 to 95		−22
96 to 99		−23
100 to 103		−24
104 to 106		−25
107 to 110		−26
111 to 114	* Inconsequential	−27
115 to 117	variation from the	−28
118 to 121	rule for disposal of	−29
122 to 125	decimals disregarded	−30
126 to 128	at 3 and 4 m.p.h.	−31
129 to 132		−32
133 to 136		−33
137 to 140		−34
141 to 143		−35

in this rate for the past five years. No definite trend in the trouble rate can be obtained as the data on removals in anticipation of failure have been collected for only three years.

The trouble rate for all cable was 7.1 troubles per 100 cable mile-years the same as last year. The service failure rate of 4.5 increased 14 per cent, the test failure rate of 1.1 decreased 14 per cent, and the removal rate of 1.5 decreased 21 per cent.

There were 1.6 joint troubles per 1000 joint-years, a value 23 per cent higher than that reported last year. The service failure rate of 0.83 increased 61 per cent, the test failure rate of 0.33 decreased 15 per cent, and the removal rate of 0.40 increased 8.3 per cent.

The pothead trouble rate of 6.4 troubles per 1000 pothead-years was practically the same as last year, the difference being only 0.5 per cent higher than in 1935. The service failure rate of 2.3 increased 1.1 per cent, the test failure rate of 0.43 increased 4.1 per cent, and the removal rate of 3.7 decreased 0.2 per cent.

Approximately one out of every five cable troubles was caused by sheath corrosion, which continued as the main source of trouble. The next most frequent cause of trouble was wearing of the cable sheath which caused 19 per cent of the troubles. Deterioration of cable insulation in cable over ten years old caused 11 per cent, external mechanical damage 9.8 per cent, and defective sheath caused 8.8 per cent of all cable troubles during 1936.

Solid type, paper-insulated cables whose joints were equipped with oil reservoirs, had a failure rate 47 per cent better than the rate for cables without reservoirs. The trouble rate, however, was 6.3 per cent higher.

Materials and Supplies Accounting

(*Continued from page* 60)

This condition has been made possible by perpetual inventories and adjusting the warehouse and control records to these inventories, by keeping the warehouse records and control cards in balance and by having the control cards and Materials and Supplies Account in agreement.

The new method of monthly pricing, extending and posting was instrumental in accomplishing the following reductions:

- 50% reduction in typing on detail ledgers and property records
- 90% reduction in pricing
- 50% reduction in extensions of prices
- 80% reduction in posting to Accounting Department record
- 100% reduction in posting to Stores Office record by location, as this was discontinued

Above figures are approximate.

Light on Power

A DRAMATIC presentation of some of the much discussed problems of the electric industry is available through the medium of a sound slide film, "Light on Power," produced by the Vocafilm Corporation, 424 Madison Avenue, New York.

Point by point the film reviews current misconceptions about utility problems, and presents basic facts that should be given weight in any discussion of them.

The picture is designed for presentation both before employees and the public, through service clubs and other gatherings. It is 30 minutes in length, but is divided into two 15-minute parts, so that the first half can be shown at one meeting, and the other half at some later time, if so desired.

A booklet bearing the same title as the sound slide film has been prepared by the producers. A page from the booklet has been reduced and is reproduced herewith. The booklet shows the actual pictures and actual dialogue used in the presentation. It was designed to leave with employees and others who attend the showings.

Duplicate prints of the sound slide film "Light on Power" (including both film and record) are available from the producer at $30 per set. The booklets are priced at 4 cents each. On quantities of 10,000 and over, a special price will be made.

"It is clear that in ascertaining the present value we are not limited to the consideration of the actual investment. If that has been reckless or improvident, losses may be sustained which the community does not underwrite."
RATES BASED ON FAIR VALUE
In other words, even if the company actually paid out good hard cash in excess of the value of a property it bought, it can't charge rates to make up for an unwise investment. Rates must be based . . .
upon fair value of a property . . . and State regulatory bodies keep a sharp eye on those values . . . they don't take any company's word for what its property is worth.
Why, not long ago the Federal Trade Commission reported that power companies had been writing up values exorbitantly.
Then, when figures were checked in detail . . .
WRITE-UP 12%
the write-up appeared to be 12 per cent. And even that 12 per cent is not based on a fictitious bookkeeping entry, but on good business practice.
How do you mean?
Well, suppose you and Ralph bought a backwoods farm.
You paid $2,000 for it, cash.
Then we'd own just a $2,000 farm.
Right. You'd put that down in your books at $2,000.
Plus whatever we spent to fix it up.
Of course. You rent it out for $200 a year. That will pay your taxes on the farm and 6 per cent on your investment.
But now a highway is built right by your place and the value goes up so that you could sell it for $3,000
Then our farm would be worth $3,000 and we could get more rent.
Not if you were a utility company, you wouldn't. That would be called a "write-up"! And criticized!
1888 1938
Actually, in 50 years, the books of the entire utility industry show a "write-up" of about five and six-tenths per cent!
Then rates have only gone up 5 per cent in that time.
Say, when electric rates go up, that's news! Electricity is the only thing we use that has not gone up! Look at rates!
1882 25¢
1913 8.7¢
1930 6¢
1937 4.7¢
1882 . . . the average price of residential electricity . . . 25 cents a kilowatt hour! And look at them drop! Eight and seven-tenths cents in 1913 . . . six cents in 1930, and four and thirty-seven hundredths cents in 1937! Down, down, down!
ELECTRIC LIVING COST OF WITH
Everything else going up, up, up! The cost of living in 1937 was 47 per cent higher than in 1913. While the cost of electricity was 49 per cent lower. And this . . .
despite the vast increase in wages, cost of materials and fuel costs in the electric industry.
$325,000,000
TAXES 1937
$2,654,000
And taxes! From $2,654,000 in 1902, to over $325,000,000 in 1937. Increase in taxation 100 times in 35 years! Remember the nation's residence electric bill in 1937 was $740,000,000.

Some of the scenes and script from "Light on Power."

Utilities Will Help

(*Continued from page 45*)

financing feature was abused. This class of business stood too prominently in the loss column. They are not included. At time of writing, ranges are questionable, but the water heater is eligible.

A borrower with an assured income can obtain as high as $10,000 to repair and improve present structures and may borrow amounts up to $2,500 for the erection of new structures. For example, a home owner may borrow to build a garage. Repayments of loans for repair work may be spread over five years and for new construction over ten years. Banks and other lending institutions are insured against losses up to 10 per cent of the total loans.

There is a wide variety of building activity covered in the provisions of the National Housing Act and the construction industry is alert to its opportunity. Outstanding among organized drives in promoting low-cost housing is National Small Homes Demonstration, initiated and financed by the National Lumber Manufacturers Association and the National Retail Lumber Dealers Association, but including a score and more groups in the building material field.

The Edison Electric Institute has been in close contact with all Housing activity and it is expected that utilities locally will willingly join in local building activities. Federal Housing Administration is closely cooperating since all the plans drawn for building homes varying from $1,500 to $5,000 in value are eligible for financing under the Federal Housing System of insured mortgages. This is our opportunity to have adequate wiring, lighting and other electric equipment installed in these new homes. Help get them started right. We can contribute effectively to their modernity.

Over the past two years we have had home building activities through utilities in cooperation with manufacturers such as the Kelvin Homes of the Nash-Kelvinator Corporation and the New American Homes of the General Electric Company. The Five-Star Homes of Niagara Hudson Power Corporation and the Reddy Kilowatt Homes of the Oklahoma Gas and Electric Company constituted evidence of the interest of the electrical industry in new homes of the future for all classes of people.

Federal Housing Administration gives new impetus and new help. Let the great work go on.—C. E. GREENWOOD.

CONVENTIONS AND MEETINGS

FEBRUARY

1 Canadian Electrical Association, annual winter conference, Montreal, Can.

6-7 Prime Movers Committee, EEI, Netherland-Plaza Hotel, Cincinnati, Ohio.

7-8 Electrical Equipment Committee, EEI, Netherland-Plaza Hotel, Cincinnati, Ohio.

7-12 National Electrical Manufacturers Association, New York, N. Y.

9-10 Transmission and Distribution Committee, EEI, Brown Hotel, Louisville, Ky.

MARCH

16-18 Northwest Electric Light and Power Association, Business Development Conference, Medford, Ore.

21-22 Oklahoma Utilities Association, Annual convention, Biltmore Hotel, Oklahoma City, Okla.

28-31 Annual Sales Conference, EEI, Edgewater Beach Hotel, Chicago, Ill.

APRIL

7-8 Missouri Valley Electrical Association, Engineering conference, Omaha, Neb.

7-8 Pacific Coast Electrical Association, Spring conclave, Fresno, Calif.

13-15 Missouri Association of Public Utilities, Jefferson Hotel, St. Louis, Mo.

20-23 Northwest Electric Light and Power Association, Engineering and Operating Section, Vancouver, B. C.

20-30 National Electrical and Radio Exposition, New York, N. Y.

21-23 Southeastern Electric Exchange, Annual convention, Edgewater Gulf Hotel, Biloxi, Miss.

27-30 Electrotechnical Society, Savannah, Ga.

MAY

2-5 Chamber of Commerce of the U. S. A., Washington, D. C.

2-5 Engineering Committees, Edison Electric Institute, Edgewater Beach Hotel, Chicago, Ill.

9-13 National Fire Protection Association, Atlantic City, N. J.

15-20 National Electrical Manufacturers Association, Hot Springs, Va.

22-26 National Electrical Wholesalers Association, Hot Springs, Va.

23-26 National Association of Purchasing Agents, St. Louis, Mo.

26-27 Pacific Coast Electrical Association, Annual convention, San Francisco, Calif.

JUNE

7-9 *EDISON ELECTRIC INSTITUTE, Atlantic City Auditorium, Atlantic City, N. J.

20-24 American Institute of Electrical Engineers, Washington, D. C.

20-24 American Society of Mechanical Engineers, St. Louis, Mo.

22-24 Canadian Electrical Association, annual convention, Seigniory Club, Province of Quebec, Canada.

The R. B. Marshall Award

(*Continued from page 50*)

2. The closed "Sale" and installation of a range will be counted as TWO points. A range on "Trial" or on "Rental" will be credited with ONE point.

If a range on "Trial" or "Rental" is sold within the period of the contest, another point can be recorded.

3. A range on "Trial" or on "Rental" must be in service on the premises of a customer for at least three months to be counted as one point.

4. Sales at wholesale to apartment houses are not to be considered in the results.

5. The salesman's record of accomplishments must be approved by the Chief Commercial Executive of the utility company who should forward it in a letter giving the results in points together with an expression of the general sales ability of the contestant, with particular reference to his relationship with the trade and the consumer.

6. These incidental merits of salesmanship (Item 5) will count no more than 10 per cent in the judging of the contestants.

Reports on salesmen's records should be submitted not later than March 1, 1939, to the Edison Electric Institute, 420 Lexington Avenue, New York, N. Y.